



## DASH CAT 09

### Instructions

**The passage below is accompanied by a set of questions. Choose the best answer to each question.**

Philosophers have long insisted on the complexity of our moral lives. Determining, in quiet moments of armchair reflection, what is in principle right or wrong is difficult enough; knowing what one ought to do in the press of immediate circumstances is even harder. There are often many factors to consider, and doing one thing that seems to be (and maybe is) right can require that one neglect some other duty[...]Antigone, in Sophocles' tragedy, must choose between her personal and religious duty to bury her dead brother and her civic obligation to obey the leader Creon's command that the traitor's body should be left to the vultures. Her moral conflict is real. Circumstances might be such that we can't possibly satisfy all of our duties, much less all of our desires. Sometimes, the best we can do is opt for the lesser of two evils.

Some philosophical traditions, troubled by such apparent complexity, aspired to reduce ethics to a single, ultimate principle, to the quasi-mechanical application of a rule that is supposed to provide a unique, unambiguous and morally correct answer in every situation. For utilitarians such as Jeremy Bentham and John Stuart Mill, it is the principle of utility, or maximising happiness: you should always do the action whose anticipated outcome is a net increase in the wellbeing of all who are affected by the action. Immanuel Kant for whom consequences are morally irrelevant when determining the rightness of an action, insisted that the operative principle is the 'categorical imperative': you should always act in such a way that you, as a purely rational moral agent, regardless of your personal inclinations or preferences, could will the maxim of the action to become a universal law that commands all moral agents to act that way. In other words, can you reasonably envision that all people should be directed (or even allowed) to act in that way?

As many philosophers have noted, such simplicity and uniqueness of principle is neither desirable nor practical. Reductionism of this kind can easily lead to questionable, even objectionable consequences. The Kantian principle, for example, generates the absolute moral duty never to make a false promise or tell a lie, since no rational agent could possibly envision a universal law that allows people to make false promises or tell lies when it is convenient for them to do so. Such a law would render false promises and lies themselves impossible, since the trust required for these sorts of deceptions would be undermined. Kant, however, means his principle to apply even to situations where the outcome of telling the truth is morally abhorrent - for example, when Nazis in 1943 come to your door in Amsterdam demanding to know whether you're hiding a Jewish family in your home.

[...]Sometimes, there are clear limits to utilitarian reasoning, strong moral reasons not to do the action, no matter how much happiness that action would generate. The enslavement of a minority population is, in principle, morally impermissible, regardless of how happy it would make the majority. On the other hand, sometimes there are good utilitarian reasons to violate what had seemed an absolute moral proscription. A lie that saves a life or even simply eases a friend's suffering might be permissible...Moral agency cannot consist simply in the mechanical application of a universal principle.



**1. Based on the passage, the author is most likely to agree with which of the following statements?**

- A. Sticking to morally subjective principles instead of absolute moral proscriptions might help avoid situations that otherwise have morally horrifying consequences.
- B. If applied incorrectly, the utilitarian principle of maximising well-being allows for societal issues - such as the enslavement of minorities - to crop up.
- C. The cursory application of a generalised principle leads to morally contentious and unacceptable outcomes.
- D. Certain actions - such as lying - are considered morally detestable despite specific circumstances justifying them.

**Sol. Option A:** This is beyond the scope of discussion; it is difficult to determine the author's stance on this subject. While he does talk about how there could be compelling reasons not to stick to absolute moral proscriptions, we cannot infer that he wants to do away with them. Hence, Option A can be eliminated.

**Options B and C:** The author is against using universal principles in any form: "As many philosophers have noted, such simplicity and uniqueness of principle are neither desirable nor practical. Reductionism of this kind can easily lead to questionable, even objectionable consequences." Hence, the caution at the beginning of the statement in B does not make sense.

Furthermore, we can identify that Option C aligns with the claim discussed above.

**Option D:** There is no information on this subject; we cannot determine if the author will agree to this statement.

Hence, Option C is the correct choice.

**2. The author cites the example of Antigone from Sophocles' tragedy**

- A. To portray how, in some instances, choosing the lesser of two evils is the only morally appropriate course of action.
- B. To emphasise that pressing circumstances often present dilemmas wherein determining the morally correct choice is difficult.
- C. To highlight that moral conflict in real-life situations does not compare to imaginary ones that constitute armchair reflection.
- D. To suggest that Antigone's moral dilemma could have been solved using a universal principle such as the ones offered by Kant or Bentham.

**Sol.** Before citing Antigone, the author talks about the difficulty in (and the complexity associated with) making a morally correct choice. {"Philosophers have long insisted on the complexity of our moral lives. Determining, in quiet moments of armchair reflection, what is in principle right or wrong is difficult enough; knowing what one ought to do in the press of immediate circumstances is even harder."}

In the subsequent paragraph, he talks about the reduction of moral elements into a universal principle due to this complexity. {"Circumstances might be such that we can't possibly satisfy all of our duties, much less all of our desires. Sometimes, the best we can do is opt for the lesser



of two evils...Some philosophical traditions, troubled by such apparent complexity, aspired to reduce ethics to a single, ultimate principle, to the quasi-mechanical application of a rule that is supposed to provide a unique, unambiguous and morally correct answer in every situation.”}

Thus, the example of Antigone showcases the difficulty of making such a choice under pressing circumstances; Option B correctly captures this.

Option A is not the focus; rather than the decision itself, the difficulty in making such a decision is being emphasised. Similarly, Option C strays from the intention; the author does not seek to present a comparison between the two settings. The author would discard Option D since he does not feel that universal principles help resolve moral conflicts.

Hence, Option B is the correct choice.

### 3. Which of the following correctly captures the limitation of the Kantian principle as presented by the author?

- A. The usage of the Kantian principle creates a tussle between absolute moral duties, thereby deepening the moral conflict a rational agent faces.
- B. The utility of the Kantian principle is limited to situations wherein objective decisions can be made without the influence of personal inclinations.
- C. The application of the Kantian principle could lead to morally abhorrent outcomes despite the best intentions of a rational agent.
- D. The use of Kantian principles could be at odds with the legal and social constraints in the system, amplifying the moral conflict.

**Sol.** “The Kantian principle, for example, generates the absolute moral duty never to make a false promise or tell a lie, since no rational agent could possibly envision a universal law that allows people to make false promises or tell lies when it is convenient for them to do so. Such a law would render false promises and lies themselves impossible, since the trust required for these sorts of deceptions would be undermined. Kant, however, means his principle to apply even to situations where the outcome of telling the truth is morally abhorrent - for example, when Nazis in 1943 come to your door in Amsterdam demanding to know whether you’re hiding a Jewish family in your home.”

The discussion begins with the idea of how resolving moral conflicts is immensely challenging. In this context, the Kantian principle further aggravates the situation by causing friction between two or more 'moral duties'. The example relating to the Nazis serves to clarify this idea. Being 'honest' would be an absolute moral duty; however, when seen alongside the duty of 'not harming others', both could be in conflict - a situation wherein honesty causes harm to others. Hence, instead of helping us resolve the situation, the application of the Kantian principle appears to aggravate the issue. [This seems paradoxical since the principle complicates the dilemma it was created to solve] Option A correctly presented the above idea and hence, is the correct choice.





**4. All of the following qualify as a valid criticism of the utilitarian principle EXCEPT:**

- A. A standardized, objective method to quantify and measure happiness is difficult, if not impossible, to devise.
- B. Given the constraint of maximising happiness, it would be impossible to resolve moral conflicts since actions that are supported in some situations would be condemned in others.
- C. As long as happiness is maximized, morality becomes arbitrary since the principle supports acts that can be considered objectively heinous or questionable.
- D. The principle encourages individuals to maximize happiness by maximizing economic benefits leading to increased social competitiveness.

**Sol.** The utilitarian principle is presented as follows: “For utilitarians such as Jeremy Bentham and John Stuart Mill, it is the principle of utility or maximising happiness: you should always do the action whose anticipated outcome is a net increase in the wellbeing of all who are affected by the action.”

Option A is a valid criticism since it attacks the assumption that a net increase in happiness/well-being can be measured.

Option B: Since maximising happiness justifies certain actions, the moral value of any action becomes arbitrary and contextual. Hence, resolving conflicts would become impossible; therefore, Option B is a valid criticism.

Option C: The author touches upon this idea when he says that heinous actions can be justified under the facade of maximizing happiness. {"The enslavement of a minority population is, in principle, morally impermissible, regardless of how happy it would make the majority."}

Option D: It is unclear how increased social competitiveness is detrimental/undesirable. If anything, it could have a positive effect, such as increased innovation or trade leading to complex socio-political setups. We cannot confirm the validity of this statement, and hence, Option D is the correct choice.

**Instructions**

**The passage below is accompanied by a set of questions. Choose the best answer to each question.**

Earth’s magnetic field, nearly as old as the planet itself, protects life from damaging space radiation. But 565 million years ago, the field was sputtering, dropping to 10% of today’s strength, according to a recent discovery. Then, almost miraculously, over the course of just a few tens of millions of years, it regained its strength—just in time for the sudden profusion of complex multicellular life known as the Cambrian explosion.

What could have caused the rapid revival? Increasingly, scientists believe it was the birth of Earth’s inner core, a sphere of solid iron that sits within the molten outer core, where churning metal generates the planet’s magnetic field. Once the inner core was born, possibly 4 billion years after the planet itself, its treelike growth—accreting a few millimetres per year at its surface—would have turbocharged motions in the outer core, reviving the faltering magnetic field and renewing the protective shield for life. “The inner core regenerated Earth’s magnetic field at a really interesting time in evolution,” says John Tarduno, a geophysicist at the University of Rochester. “What would have happened if it didn’t form?”



Just why and how the inner core was born at that moment is one of many lingering puzzles about the Pluto-size orb 5000 kilometres underfoot. “The inner core is a planet within a planet,” says Hrvoje Tkalčić, a seismologist at Australian National University (ANU)—with its own topography, its own spin rate, its own structure. “It’s beneath our feet and yet we still don’t understand some big questions,” Tkalčić says.

But researchers are beginning to chip away at those questions. Using the rare seismic waves from earthquakes or nuclear tests that penetrate or reflect off the inner core, seismologists have discovered it spins independently from the rest of the planet. Armed with complex computer models, theorists have predicted the structure and weird behaviour of iron alloys crushed by the weight of the world. And experimentalists are close to confirming some of those predictions in the lab by re-creating the extreme temperatures and pressures of the inner core.

Arwen Deuss, a geophysicist at Utrecht University, feels a sense of anticipation that may resemble the mood in the 1960s when researchers were observing seafloor spreading and on the cusp of discovering plate tectonics, the theory that makes sense of Earth’s surface. “We have all these observations now,” she says. It’s simply a matter of putting them all together.

The ancients thought Earth’s centre was hollow: the home of Hades or hellfire or a realm of tunnels that heated ocean waters. Later, following erroneous density estimates of the Moon and Earth by Isaac Newton, Edmond Halley suggested in 1686 that Earth was a series of nested shells surrounding a spinning sphere that drove the magnetism witnessed at the surface.

Basic tenets of planet formation provided a more realistic picture. Some 4.5 billion years ago, Earth was likely born from the collisions of many asteroidlike “planetesimals.” The dense iron in the planetesimals would have sunk to the core of the molten proto-Earth, while lighter silicate rocks rose like oil on water to form the mantle. At temperatures of thousands of degrees and millions of atmospheres of pressure, the core would have remained molten, even as Earth’s mantle and crust cooled and hardened.

### 5. Why does the author quote Arwen Deuss?

- A. to show the sense of anticipation among researchers, given how the discovery of the inner core might be more significant than the discovery of plate tectonics in the 1960s.
- B. to draw a parallel between plate tectonics in the 1960s which allowed us to make sense of Earth’s surface and the inner core which will allow us to make sense of the Earth’s inner workings.
- C. to highlight that researchers now possess the relevant information needed to make a breakthrough in the field like plate tectonics did in the 1960s.
- D. to emphasise the anticipation among researchers in the field, given the significant implications of fully understanding the inner core.

**Sol.** Arwen likens the existing mood in the field to the one observed in the 1960s when researchers were on the cusp of discovering plate tectonics that had significant implications [it helped them “make sense of Earth’s surface”] This signifies that researchers today anticipate that they’ll soon make a breakthrough given the information that they possess on the inner core and this will have important ramifications. We can glean that greater clarity on the inner workings of the core has immense value to those in the field. Hence, the author intends to emphasise the anticipation among researchers in the field, given the significant implications of fully understanding the inner core. Option D correctly captures this.



Option A: The author does not claim or imply that the discovery of the inner core might be more significant than the discovery of plate tectonics in the 1960s. Hence, we can eliminate this choice.

Option B: The author does make such a comparison; it is not stated that more understanding of the inner core will allow us to "make sense" of the Earth's inner working, akin to how plate tectonics in the 1960s allowed us to 'make sense' of Earth's surface.

Option C: While the belief about the breakthrough might be correct, the state of affairs cannot be justifiably compared to the situation in the 1960s.

Hence, Option D is the correct choice.

**6. Researchers are curious about the concurrence of the Cambrian explosion and the regeneration of Earth's magnetic field because**

- A. they understand that the occurrence of the former is contingent on the occurrence of the latter.
- B. they understand that the former cannot occur had the latter not taken place.
- C. they wonder if the former would have happened had the latter not taken place.
- D. they surmise that the former would be unlikely to occur in the latter's absence.

**Sol.** "Then, almost miraculously, over the course of just a few tens of millions of years, it regained its strength—just in time for the sudden profusion of complex multicellular life known as the Cambrian explosion."

"The inner core regenerated Earth's magnetic field at a really interesting time in evolution," says John Tarduno, a geophysicist at the University of Rochester. "What would have happened if it didn't form?"

Researchers are curious about the concurrence of these events primarily because they wonder if the evolutionary process would have been impacted had the Earth not regained the strength of its magnetic field. Although implicit, the author states the significance of the magnetic field in sheltering life from cosmic radiation at the very beginning; the regeneration of the magnetic field just in time for the Cambrian evolution is indeed miraculous. Option C correctly captures their attitude. Researchers are yet to develop a definitive correlation between the two events; all they can do is to wonder. Hence, the remaining options can be eliminated.

**7. Which of the following is true about the inner core of the earth?**

- A. The rare seismic waves originating from the core allowed scientists to uniquely determine its spin rate and subsequently, some of its inner workings.
- B. While little is known and understood about the core, scientists say - with some confidence - that its structure and motion differ from that of the Earth.
- C. Hrvoje Tkalčić believes that one could visualise the core as a planet within a planet, given how it is similar to Pluto in terms of size and composition.
- D. Researchers believe that the birth of the core 4 billion years ago surprisingly coincided with the Cambrian explosion - a time that marked a sudden profusion of complex multicellular life.





**Sol. A:** It has not been mentioned that the inner core gives off seismic waves but that it reflects these waves when given off during earthquakes.

**B:** “The inner core is a planet within a planet,” says Hrvoje Tkalčić, a seismologist at Australian National University (ANU)—with its own topography, its own spin rate, its own structure.

From the above excerpt, we can see that Option B is true.

**C:** Though similar to Pluto in size, it has not been mentioned that it is also similar in terms of composition.

**D:** The statement here contains a minor distortion. The author states that the birth of the core took place possibly 4 billion years after the planet itself.

Hence, Option B is the correct answer.

**8. Which of the following correctly captures the purpose of the last two paragraphs?**

**A.** The erroneous idea of the Earth’s magnetic field is depicted, followed by clarification offered for the same by Edmond Halley and reinforced by recent theories on planet formation.

**B.** The general conception of the Earth’s structure during older periods is traced, followed by a more recent and realistic understanding of the same drawn from the basic tenets of planet formation.

**C.** The older misconceptions regarding the Earth’s structure are presented, followed by a more likely explanation for the same drawn from our current understanding of planet formation.

**D.** The ancient belief regarding Earth’s hollow centre is presented alongside Newton’s erroneous density estimates, both of which are subsequently disproved using the basic tenets of planet formation.

**Sol.** The ancients thought Earth’s centre was hollow: the home of Hades or hellfire or a realm of tunnels that heated ocean waters. Later, following erroneous density estimates of the Moon and Earth by Isaac Newton, Edmond Halley suggested in 1686 that Earth was a series of nested shells surrounding a spinning sphere that drove the magnetism witnessed at the surface.

The penultimate paragraph contains two examples of older theories about the Earth’s core/structure that have since been pushed aside; a more realistic picture drawn from the tenets of planet formation exists today. The current understanding is highlighted in the last paragraph. Hence, the author first discusses these older misconceptions regarding the Earth’s structure and then presents a more likely explanation for the same drawn from the principles of planet formation. Option C correctly captures this.

Option A is incorrect since the focus is not solely on the magnetic field but also on the Earth’s core. Option B includes the word ‘trace’, which does not justify the discussion - the author does not chronologically trace various beliefs but presents two simple examples. Option D contains a distortion: Newton’s erroneous estimates were called out by his contemporary Edmond Halley. Furthermore, Halley’s conception of the Earth’s structure is also touched upon; the author states that this idea is also not supported by recent theories.

Hence, Option C is the correct choice.





## Instructions

The passage below is accompanied by a set of questions. Choose the best answer to each question.

Extensive research shows that disagreement - even the well-evidenced, politely delivered kind - does very little to change someone's opinion. Often, it simply pushes that person to drive their flag further into the ground. Rather than change minds, exposure to opposing views can actually further shunt people to the other end of the spectrum. One 2018 experiment paid Republicans and Democrats to follow Twitter bots collating messages from the opposing side; they discovered both groups became more polarised, not less. When I am on Twitter, I find myself hating everything and everyone - especially myself - wasting their lives arguing about nothing. I lose my ability to empathise, to see humanity beyond the avatars. Never am I more disconnected than when I am plugged in.

Even those ostensibly on the same side find themselves locked into death spirals of disagreement. As the academic Julia Bell writes in her clarifying 2020 essay, *Radical Attention*: "Consensus politics, or even any kind of politics, becomes impossible, because we are too outraged to actually think. So busy interacting, raging and denouncing that we are tricked into thinking we are actually changing something, rather than just responding to these manufactured demands on our attention."

Existing in a state of constant fury on Twitter doesn't equate to full-blown extremism. But the obsessive, feverish, zero-sum nature of Twitter discourse certainly contributes to an environment that breeds, at best, suspicion and hostility to opposing worldviews and, at worst, festering radicalisation. Transphobia is an obvious example; Twitter has seen the spread of anti-trans views beyond the confines of niche forums to become a moral panic.

The thing is, the extreme division that characterises Twitter is not widespread in society at large. Research by King's College London's (KCL) Policy Institute in 2019 found that while people had become more polarised based on their political identities, for example, Brexiters and remainers, differences in opinion on specific policies, such as immigration, were in fact starting to converge.

As of 2021, only 28% of the UK population uses Twitter. But it has outsize influence. What matters is who is on there: which people are experiencing the white-hot anger of engaging daily with the timeline. "Political elites are on Twitter every day, and for all the warnings that Twitter isn't real life, it feels like real life to them," said Ezra Klein, the author of *Why We're Polarised*, in a 2020 interview with the *Verge*. "They're stuck in a hyper-polarised informational system and it influences the candidates they support, the messages they emphasise, the stories they focus on."

[...]As Klein put it: "If [elites] become more polarised, and act in more polarised ways, that will ultimately polarise the public simply by presenting them with very polarising choices to respond to." The antagonism and extremes of Twitter may not be "real life". But as long as enough of the people who decide what "real life" looks like are spending time scrolling, it doesn't really matter.



**9. The objective of the experiment mentioned in the first paragraph was to identify:**

- A. the correlation between exposure to opposite views and polarization.
- B. the relationship between polarising viewpoints and the extent of change in personal opinion.
- C. the role of Twitter (or any other social platform) in shaping public opinion on certain topics.
- D. the mechanism via which constant exposure to conflicting ideas can lead to more disconnectedness.

**Sol.** Rather than change minds, exposure to opposing views can actually further shunt people to the other end of the spectrum. One 2018 experiment paid Republicans and Democrats to follow Twitter bots collating messages from the opposing side; they discovered both groups became more polarised, not less.

Based on the above excerpt, we identify that the experiment was undertaken to determine the effect on people's position after they were exposed to opposing views; it was found that they became more polarized. Hence, Option A is the correct answer - we establish a correlation between the two facets.

Option B distorts the discussion. The polarising effect of opposing viewpoints is being examined instead of 'polarising viewpoints'.

Option C is too broad in scope.

Option D distorts what the author is trying to convey. The author does not try to expand on the underlying mechanism; instead, he tries to establish a correlation ['how' is not the focus].

**10. Which of the following has been mentioned in the passage as a reason why people find themselves locked into death spirals of disagreement?**

- A. Being exposed to views different from their own makes people more entrenched in their position.
- B. People are unable to reflect upon their views in the contemporary modes of debate.
- C. People do not think before expressing their views and this prevents any reconciliation.
- D. There is a lack of empathy due to the disconnected nature of online interaction.

**Sol.** Even those ostensibly on the same side find themselves locked into death spirals of disagreement. As the academic Julia Bell writes in her clarifying 2020 essay, Radical Attention: “Consensus politics, or even any kind of politics, becomes impossible, because we are too outraged to actually think. So busy interacting, raging and denouncing that we are tricked into thinking we are actually changing something, rather than just responding to these manufactured demands on our attention.”

In the above excerpt, it has clearly been mentioned that the unending disagreement stems due to people being too outraged about arguing and missing out on reflecting upon their views. Hence, the correct answer is Option B.

A: Option A has been mentioned in the previous paragraph and not in the context of the 'death spirals of disagreement'.



C: It has not been mentioned that people speak without thinking, but that people do not get the chance to think while arguing.

D: Option D has not been mentioned in the context of the question.

**11. The author cites the Research by King's College London's (KCL) Policy Institute in 2019 to**

A. emphasise how specific political policies appeal to people on both sides of the political fence in real-life.

B. show how public reaction in real life depends on the policy under scrutiny, unlike the political discourse on Twitter.

C. depict the discrepancy in political attitudes online and in real life, especially concerning certain policies.

D. highlight how the real-life political discourse on some topics does not reflect the divisiveness that pervades Twitter.

**Sol.** The thing is, the extreme division that characterises Twitter is not widespread in society at large. Research by King's College London's (KCL) Policy Institute in 2019 found that while people had become more polarised based on their political identities, for example Brexiters and remainers, differences in opinion on specific policies, such as immigration, were in fact starting to converge.

As mentioned in the above excerpt, the extreme division that characterises Twitter is not pervasive in the real world. Hence, Option D is the correct answer.

Options A, B, and C are neither mentioned nor implied in the passage.

**12. Twitter exercises influence that is disproportionate to its user base due to:**

A. the impact on political attitudes due to its hyper-polarised informational system.

B. the polarized nature of Twitter as compared to the real world.

C. the influence of the people who actually use Twitter.

D. the antagonism and extremes that it fosters among the public.

**Sol.** As of 2021, only 28% of the UK population uses Twitter. But it has outsize influence. What matters is who is on there: which people are experiencing the white-hot anger of engaging daily with the timeline.

From the above excerpt, we can infer that the outsized influence of Twitter is due to who is on there, which refers to the influence of the Twitter user base. Hence, Option C is the correct answer here.

Option A is partly true; however, it fails to capture the significance/end result of the change in political attitudes. The author highlights that the effect of such discourse on influential people might often manifest itself (perhaps as policies/laws) in the public domain. Hence, it is because of the influential participants on the platform that Twitter exerts such disproportionate influence.



Options B and D are not discussed in the context of Twitter's disproportionate influence and thus, can be eliminated.

### Instructions

The passage below is accompanied by a set of questions. Choose the best answer to each question.

Although psychologists are divided on exactly how to define perceived meaning in life - some suggest it is about making sense of one's life, others that it's about seeing value and significance in it - they often assess meaning in life simply by asking how strongly people agree with statements such as: 'At present, I find my life very meaningful.' And research has consistently supported the idea that perceived meaning in life is tightly linked with religion. One study from the 1970s found that nuns scored higher on such measures than laypeople. More recently, a study published in 2021 found that theists report experiencing more meaning in life than atheists. Numerous other studies have found that religiousness is positively correlated with perceived meaning in life. There is also some experimental evidence that, when presented with a threat to their sense of meaning, people show increased belief in miraculous events - suggesting that they are turning to religion to bolster their perceptions of meaning in life.

Of course, the observation that religion can be a source of existential comfort is not new. Since the 19th century, philosophers (eg, Friedrich Nietzsche), novelists (eg, Fyodor Dostoyevsky) and sociologists (eg, Émile Durkheim) have speculated that societal trends away from religion would lead to a crisis of meaning. Since recent data indicate that people around the world are becoming less religious, it is natural to wonder whether secular society can duplicate the existential benefits of religion. In order to do so, we would need to understand how it is, exactly, that religious faith makes life feel meaningful.

One possible explanation has to do with the way religion tends to act like social glue, drawing the faithful into like-minded communities. People often find social support and a sense of belonging within such communities, which can be a powerful source of perceived meaning in life. Imagine, for instance, the close personal relationships that someone might find in a Bible study group. Hence, one route from religion to the feeling that life is meaningful could be through this sense that one matters to others. We can call this explanation the 'social mattering hypothesis'.

Another possibility is that religious faith helps people to feel that they matter not just to others, but in the grand scheme of things. The observable universe is inconceivably vast and ancient: it is approximately 93 billion light-years in diameter and c14 billion years old. Against that backdrop, it's easy to see why some regard humanity as utterly insignificant. As Stephen Hawking once put it, science tells us that humanity 'is just a chemical scum on a moderate-size planet, orbiting around a very average star in the outer suburb of one among a hundred billion galaxies'. That's not a particularly uplifting thought. In fact, in the experiment mentioned above, the 'threat' used to reduce participants' sense of meaning was an essay about the smallness of human life in the vast expanse of time and space.





**13. Which of the following would most weaken the conclusion that the author has drawn from the studies mentioned in the first paragraph?**

- A. Theists' scores on the perceived meaningfulness of life vary widely across different regions.
- B. People who are economically well-to-do are more likely to have the time to pursue religious beliefs and are also less likely to be disenchanting with life.
- C. On average, people who adopt a religion are already more optimistic than other people.
- D. In the countries with the lowest scores in perceived meaningfulness of life, like China, the governments have put strict restrictions on religious practices.

**Sol.** One study from the 1970s found that nuns scored higher on such measures than laypeople. More recently, a study published in 2021 found that theists report experiencing more meaning in life than atheists.....suggesting that they are turning to religion to bolster their perceptions of meaning in life.

The above excerpt highlights the studies mentioned in the question. The studies showed that theists scored higher on the measures of a meaningful life than laypeople. The author concludes that this is due to their religion bolstering their perception of meaning in life.

To weaken this, we need to show that the theists scored higher on these measures because of reasons other than religion bolstering their perceptions of meaning in life.

A: Option A does not specify whether the variation mentioned is contradictory to the author's conclusion. It is possible that the variation is high, but the theists still score high compared to others.

B: Option B is the correct answer. It provides an alternative explanation to the correlation observed between religiousness and perceived meaning in life - both are driven by economic prosperity. Thus, not theism but economic prosperity has been identified as the root cause for perceived meaning in life.

C: Optimism is not the same as meaning attributed to life. Hence, Option C neither strengthens nor weakens the conclusion.

D: Option D strengthens the conclusion and can be easily eliminated.

**14. Based on the passage, which of the following can be one of the factors that can explain the waning of religion across the world?**

- A. People are increasingly turning towards materialistic aspects of life that makes the concept of religion irrelevant to them.
- B. People are unable to choose between the plethora of religions that exist, making them turn to secularism instead.
- C. The information revolution has reinforced people's conception of the meaning of life, thus eliminating all dangers to it.
- D. Most religions have become irrelevant in today's time due to an overt focus on orthodox rituals and practices.

**Sol.** Since recent data indicate that people around the world are becoming less religious, it is natural to wonder whether secular society can duplicate the existential benefits of religion. In



order to do so, we would need to understand how it is, exactly, that religious faith makes life feel meaningful.

The author mentions that people across the world are becoming less religious. This would mean that the benefits that religion provides to the people are not lucrative enough to make them adopt theism.

There is also some experimental evidence that, when presented with a threat to their sense of meaning, people show increased belief in miraculous events - suggesting that they are turning to religion to bolster their perceptions of meaning in life.

In the passage, it has been mentioned that people turn to religion when their sense of meaning is threatened. Hence, according to the passage, people might stop turning to religion if religion no longer allays the dangers to the meaning in life, or if people are not facing any threats to their sense of meaning at all.

Option C states that due to the information revolution, the sense of meaning has become so strong that there are no longer any dangers to it. Thus, people have no incentive to turn to religion. Option C is the correct answer.

**15. The term 'social mattering hypothesis' can be best described as:**

- A. Religion making people feel included and stating their existence as meaningful.
- B. People finding themselves as an important and meaningful part of the whole.
- C. Religion ascribing meaningful roles to each and every member of the society.
- D. People finding life meaningful due to the role they play in others' lives and in society.

**Sol.** Imagine, for instance, the close personal relationships that someone might find in a Bible study group. Hence, one route from religion to the feeling that life is meaningful could be through this sense that one matters to others. We can call this explanation the 'social mattering hypothesis'.

The author mentions that one can find meaning in life through the sense that their life matters to others. Hence, a person finds meaning in life due to the role they play in the lives of others. The author dubs this the social mattering hypothesis. Hence, Option D is the correct answer here.

A: The hypothesis is not about religion espousing that people's lives are meaningful, but the people themselves finding their lives as meaningful due to the role that they play in the lives of others.

B: Option B misses out on the fact that they find their lives meaningful.

C: Having a meaningful role in society, and finding meaning in one's life, are two different things.

**16. Which of the following best summarizes the main point of the last paragraph of the passage?**

- A. The insignificance human lives feel in the context of the age and the vastness of the physical universe is compensated by a tether to a higher power through theism.



- B. To make sense of the vast space, of which humans are but an inconsequential part, humans drew up the concept of theism to give meaning to their lives.
- C. In this vast and ancient universe, humans are but a chance aggregation of chemical matter, and life is something that arose out of this chance combination.
- D. Since humans are a part of such a vast world, the only way they can make themselves feel special is through practising an oddity like religion.

**Sol.** Another possibility is that religious faith helps people to feel that they matter not just to others, but in the grand scheme of things. The observable universe is inconceivably vast and ancient: it is approximately 93 billion light-years in diameter and c14 billion years old. Against that backdrop, it's easy to see why some regard humanity as utterly insignificant. As Stephen Hawking once put it, science tells us that humanity 'is just a chemical scum on a moderate-size planet, orbiting around a very average star in the outer suburb of one among a hundred billion galaxies'. That's not a particularly uplifting thought. In fact, in the experiment mentioned above, the 'threat' used to reduce participants' sense of meaning was an essay about the smallness of human life in the vast expanse of time and space.

The last paragraph deals with an alternate explanation of how religion helps people find meaning in their lives. The author highlights that human existence is modest in context of the age and the vastness of the universe. Hence, the way that we find meaning in our lives is through association with a higher power such as god, which makes our existence appear larger than it is. Hence, Option A is the correct answer.

- B: Is distorted. The concept of theism is not used to make sense of the universe, but to highlight humans' place in it.
- C: Misses out on the meaning that religion accrues to life.
- D: Option D distorts what has been presented in the passage by labelling religion as oddity and the only way humans can feel special.

**17. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.**

1. AIM finally shut down in December 2017, when the cost of running its messaging protocol for just a few million remaining users became too costly to justify.
2. But those highs were followed by a dot com crash that caused years of repeated layoffs until only a skeleton crew of support staff remained.
3. The 2000s brought soaring popularity that drove AIM's user base up to more than 61 million and its staff up to 100.
4. As Americans embraced instant messaging at the office and at home, AIM was the site of everything from mundane work chats to teenagers' daring romantic confessions.

**Sol.** A brief reading of the sentences suggests that the paragraph is about the highs and lows that AIM experienced in its growth. 3 opens up the paragraph by setting up the company and the era being talked about. 4 then further highlights the cause of these highs. 2 then contrasts this by pointing out the undoing of the company. 1 then concludes the paragraph, by mentioning the end result.

Hence, the correct sequence is 3421.



18. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.

1. It was emblematic of the long and complex interaction between the two countries.
2. This encounter wasn't the most significant between the royal families of Britain and Japan or the most extravagant - the princes bought a metal teapot and cups as a gift for their father in a nascent tourist market.
3. In 1881, two young British princes serving as midshipmen in the Royal Navy visited Japan, where they had a meeting with the emperor.
4. While in Japan, the princes, aged just 16 and 17, got tattoos on their arms: a couple of storks for Prince Albert and a dragon and a tiger for the future George V, Prince George.

**Sol.** A brief reading of the sentences suggests that the passage is about the encounter between the royal families of Britain and Japan. 3 serves as an apt opening sentence that sets the context and introduces the era in which the encounter is set in. We need to see the thought flow of the paragraph to see which sentence would follow. 4 goes in a different direction, and placing it after the opening sentence would break the flow. Thus, 3 should be followed by either 1 or 2.

Here, 2 needs a sentence after it to make sense. 21 makes a great pair because of it. 2 suggests that the visit was not the most significant, but emblematic of the long-standing complex relationship between the two countries. 4 then ends the paragraph with an anecdote, which shows how the relationship between the royals of the two countries was. Hence, the correct sequence is 3214.

19. Five sentences related to a topic are given below. Four of them can be put together to form a meaningful and coherent short paragraph. Identify the odd one out.

1. In Tessie's defiance of the lottery she was reverting to the principle of self-preservation.
2. In fact, individual self-interests cannot be the standard of what is just and unjust.
3. For Locke, under the social contract, society can legitimately pass laws that would result in harm to individuals within that community.
4. She may not like the outcome, and she has the right to defend herself, but none of these facts makes the ritual 'unfair'.
5. In this context, Tessie's complaint about the unfairness of the lottery is a little puzzling.

**Sol.** A brief reading of the sentences suggests that the paragraph questions the justness of a lottery. 54 is a necessary pair, which highlights that the question of fairness of the lottery does not hold. The outcome could be unfavourable for a person, but this does not make it unjust or unfair. 2 then further highlights that self-interests do not decide whether something is just or unjust.

Out of 1 and 3, 3 fits with the other sentences better, and can precede sentence 5. It can set the context for 5. 1 runs tangent to the topic, as it focuses upon self-preservation being the driving factor behind Tessie's defiance, while the rest of the paragraph deals with fairness of the decision. Hence, 1 is out of the context here.





**20. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.**

Diogenes may or may not have written something: later sources quote the titles of lost works attributed to him. We also have letters alleged to be by him, although these are generally agreed to be fakes. But he had no contemporary recorder of his thoughts. We have to reconstruct his life and ideas from quotations and anecdotes in sources long after his lifetime. Some are probably genuine, others less so. It's like trying to do a jigsaw puzzle without a picture to work from, knowing that you probably don't have all the pieces and that some of the pieces that you do have might not belong to the puzzle at all.

- A. Due to the absence of any contemporary recorder of thoughts, it is impossible to identify which works of Diogenes are incorrectly attributed to him.
- B. Diogenes wrote many pieces of work but it is impossible to identify which ones are originally his and which ones are not.
- C. Trying to decode Diogenes' life is puzzling as there was no proper recorder of his works or his life, and most of his works are identified as fakes.
- D. Diogenes failed to record most of his works, making him susceptible to the attribution of fake works.

**Sol.** The main point of the passage is that since there was no contemporary recorder of Diogenes' thoughts, it is not possible to identify which works are correctly attributed to him and which ones are not. Hence, Option A is the correct answer.

- B: It is not known whether he wrote anything or not. Option B is incorrect.
- C: Diogenes' life has not been mentioned in the paragraph.
- D: For the same reason as Option B, Option D can be eliminated.

**21. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.**

1. The concept of revolt - of even imagining a world where he or she is not dependent on the system and its authoritarian practices - simply does not exist for them.
2. So effective is this system that often the individual does not even think to challenge its authority.
3. Unfortunately, keeping people in their place by not freeing them to pursue that which they find meaningful renders them unable to really think for themselves.
4. In particular, they're unable to realize the necessity to detach themselves from a repressive culture that promotes nothing but conformity and the status quo, where the people think they are free despite, for instance, the fact that they have little say in how the policies and laws enacted by those in power affect them.

**Sol.** A brief reading of the sentences suggests that the paragraph talks about the impact of repressive systems on the individual ability to think. 34 is a necessary pair, where 3 states what a repressive society does to individual thought, and 4 then delves in a particular way into how



society achieves it. Statement 2 follows 4, as 'this system' in 2 refers to the repressive culture mentioned in 4. The inability to think leads to a failure to challenge authority. Closely attached to this is the idea in 1 about revolt. Hence, the correct sequence is 3421.

**22. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.**

Previous studies have focused on the potential for warm spells of weather that involve extreme or sustained periods of high temperatures to coincide with surges in deaths and hospitalisations due to heart conditions. However, until now, findings related to age and gender have been inconsistent. Researchers from the University of Toronto in Canada set out to examine any possible link between high summer temperatures at night and increased cardiovascular disease (CVD) deaths among people aged between 60 and 69. They studied data from the Office for National Statistics on almost 40,000 adult deaths attributed to CVD for the months of June and July in every year between 2001 and 2015 in England and Wales because heatwaves in the UK are most frequent and intense during these months.

A. Owing to the inconsistent findings in previous studies, researchers from the University of Toronto undertook a study focused on the effect of high temperature at night on heart conditions for people in their 60s using data from the period 2001-2015.

B. Given the inconsistent findings in previous studies, a new study by researchers from the University of Toronto identified a positive correlation between high night temperatures and increased risk of CVD in people aged 60-69, using data from 2001-2015.

C. Based on a study using data from the period 2001-2015, researchers from the University of Toronto suggested that intense heatwaves could be deadly for people in the age group 60-69, increasing the risk of heart ailments.

D. A study involving people aged 60 to 69 using data from the period 2001-2015 overwrote certain inconsistencies observed in prior studies regarding high night temperatures and increased risk of CVD.

**Sol.** The main points of the passage are:

1. Early studies focused on the effect of extreme temperatures on heart conditions had certain inconsistencies.

2. Researchers from the University of Toronto in Canada set out to examine any possible link between high summer temperatures at night and increased cardiovascular disease (CVD) deaths

Option A comes the closest to capturing the above two points and is the correct answer.

B: There is no mention of a positive correlation yet; we are told that the researchers are still examining relevant data.

Options C and D miss out on point 1. Furthermore, Option D distorts the idea by claiming that the recent study 'overwrote' the findings of the previous studies.



23. Five sentences related to a topic are given below. Four of them can be put together to form a meaningful and coherent short paragraph. Identify the odd one out.

1. The nuances of cinematic AIs are limited only by the imaginations and savvy of their creators in all departments.
2. One of the dreams in AI is the creation of a machine that's indistinguishable from its creators.
3. The core of Alan Turing's idea is that a 'thinking machine' should be able to fool a human that it's human after a few minutes of conversation across a textual interface.
4. Popular media representations of AI introduce fully-fledged automata that would be indistinguishable from their human counterparts if it weren't for the gap between how the robot acts and how it would need to act in order to transcend its mechanistic roots.
5. More recent cinematic forays imagine this indistinguishability to be more than merely conversation-based.

**Sol.** A brief reading of the paragraph suggests that it is about AI machines that resemble humans and how they are portrayed across the cinema. One of the goals while developing AI is to make it indistinguishable from humans. While Turing imagined resemblance while conversing with the AI, the cinematic portrayal expresses a more holistic resemblance.

2 acts as an apt opening sentence, that sets the context and introduces what is being talked about. 3 is a necessary pair, that conveys the common idea of 'indistinguishability' and the leaps cinema has taken in this context. 4 then acts as an apt concluding sentence, where it has been briefly mentioned how holistic the indistinguishability is.

1 seems out of context here. Where the other sentences have a major focus on the resemblance of AI with humans, 1 is more about the nuances and the features that could be included in cinematic AIs, and how the only thing that restricts this is the creativity of the makers. Hence, 1 is the correct answer.

24. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

The beauty of a dawdling journey across Spain is that it honours distance and landscapes. Despite a couple of short, high-speed stretches, the train to Cádiz generally doesn't hurry. There's a meditative appeal in making a long journey through a litany of changing landscapes. When did you last have 12 hours to yourself? There's time to think, just daydream and gaze out of the window. Along the way, it swaps Catalonia's restrained charm for the fiery warmth and sensual appeal of the Spanish south. Remember Byron's *The Girl of Cadiz*, who was "born beneath a brighter sun".

- A. Despite a couple of short high-speed stretches, a train journey across Spain takes its time, while being visually appealing.
- B. A train journey across Spain is made fulfilling by the plethora of scenic beauty and ample time to reflect and take it all in.
- C. The visually stunning beauty of Spain can only be taken in if one takes out the time for a train journey across its awe-inspiring landscapes.
- D. Spain is known for its scenic beauty and slow trains, which allow the traveller ample time for reflection and daydreaming.



**Sol.** The main point of the paragraph is that a train journey across Spain is so fulfilling as it has ample landscapes for a person to see and ample time for a person to be by themselves and take the journey in. Option B comes the closest to capturing this, and hence, is the correct answer.

A: It misses out on the point that the longer duration of the journey allows on to reflect and absorb the beauty.

C: Option C misses out on the travelling aspect, and only mentions beauty and time.

D: Option D is beyond the scope of the paragraph. It has not been mentioned that Spain is renowned for its beauty and slow trains..

### Instructions

ABC institute scheduled two seminars, one each on "Inflation Targeting" and "Women Empowerment in Informal Sector". The auditorium they had chosen for the seminar has sitting available for only 899 people with that many chairs only arranged in the form of grid having dimensions  $31 \times 29$ . So the first 899 registered students are only allowed to attend the seminars. Each student was given a different registration number from 1 to 899 at the time of registration. Also, it was mandatory for everyone to attend both the seminars and the same registration number is valid for both.

- Rows are numbered as row 1, row 2, row 3, ..... and row 31, and columns are numbered as column 1, column 2, column 3, ....., column 29.

- For "Inflation Targeting", students were asked to sit according to their registration number in row-wise manner. For example, student with registration number 1 sits on the seat in row 1 and column 1; student with registration number 2 sits on the seat in row 1 and column 2; and so on till registration number 29. Then student with registration number 30 sits on the seat in row 2 and column 1; student with registration number 31 sits on the seat in row 2 and column 2; and so on. And hence followed the same pattern till all the students got their seats.

- For "Women Empowerment in Informal Sector", students were asked to sit according to their registration number in column-wise manner. For example, student with registration number 1 sits on the seat in column 1 and row 1; student with registration number 2 sits on the seat in column 1 and row 2; and so on till registration number 31. Then student with registration number 32 sits on the seat in column 2 and row 1; the student with registration number 33 sits on the seat in column 2 and row 2; and so on. And hence followed the same pattern till all the students got their seats.

### 25. How many students go on to seat on the same seat in both the seminars?

**Sol.** Sitting arrangement of students during the seminar titled as "Inflation Targeting" is as given below, where number mentioned in any cell is the registration number of the student sitting on that seat.





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	Column-1	Column-2	-----	Column-28	Column-29
Row-1	1	2		28	29
Row-2	30	32		57	58
Row-3	59	60		86	87
-					
-					
-					
Row-30	842	843		869	870
Row-31	871	872		898	899

If we observe the above table, we can see every row has consecutive numbers starting from  $29 \times (\text{row} - 1) + 1$ . So, the general term for the above table can be written as  $C_{ij} = 29(i-1) + j$ , where  $C_{ij}$  represents the seat in  $i$ th row and  $j$ th column.

Similarly, sitting arrangement of students during the seminar titled as “Women Empowerment in Informal Sector” is as given below

	Column-1	Column-2	-----	Column-28	Column-29
Row-1	1	32		838	869
Row-2	2	33		839	870
Row-3	3	34		840	871
-					
-					
-					
Row-30	30	61		867	898
Row-31	31	62		868	899

So, the general term for the above table can be written as  $C_{ij} = 31(j-1) + i$ .

The student having same  $C_{ij}$  value for both the seminars, got to sit on the same seat,

Therefore,  $29(i-1) + j = 31(j-1) + i$

or,  $15j - 14i = 1$

Only possible positive integer solutions of the above equations are (1,1), (16,15) and (31,29). Therefore, 3 students got to sit on same seat in both the seminars.



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26. If a student got seat in row 13 and column 14 in the seminar "Inflation Targeting", and in row number 'p' and in column number 'q' in "Women Empowerment in Informal sector", then find the value of p+q.

**Sol.** Sitting arrangement of students during the seminar titled as "Inflation Targeting" is as given below, where number mentioned in any cell is the registration number of the student sitting on that seat.

	Column-1	Column-2	-----	Column-28	Column-29
Row-1	1	2		28	29
Row-2	30	32		57	58
Row-3	59	60		86	87
-					
-					
-					
Row-30	842	843		869	870
Row-31	871	872		898	899

If we observe the above table, we can see every row has consecutive numbers starting from  $29 \times (\text{row} - 1) + 1$ . So, the general term for the above table can be written as  $C_{ij} = 29(i-1)+j$ , where  $C_{ij}$  represents the seat in  $i$ th row and  $j$ th column.

Similarly, sitting arrangement of students during the seminar titled as "Women Empowerment in Informal Sector" is as given below

	Column-1	Column-2	-----	Column-28	Column-29
Row-1	1	32		838	869
Row-2	2	33		839	870
Row-3	3	34		840	871
-					
-					
-					
Row-30	30	61		867	898
Row-31	31	62		868	899

So, the general term for the above table can be written as  $C_{ij} = 31(j-1)+i$ .

For seminar on "Inflation Targeting"  $C_{ij} = 29(i-1)+j$ , and as per question  $i = 13$  and  $j = 14$



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Therefore, Registration Number  $C_{ij} = 29(13-1) + 14 = 362$

For seminar on "Women Empowerment in Informal Sector"  $C_{ij} = 31(j-1)+i$

or,  $31(q-1) + p = 362$

or,  $(31 \times 11) + 21 = 362$

or,  $p = 21$  and  $q = 12$   
 $p + q = 21 + 12 = 33$

**27. A student with registration number X sits in seminar "Inflation Targeting" in row number 'a' and column number 'b'. The same student sits in seminar "Women Empowerment in Informal Sector" in row number 'b' and column number 'a'. Then find the sum of all such possible values of X.**

**Sol.** Sitting arrangement of students during the seminar titled as "Inflation Targeting" is as given below, where number mentioned in any cell is the registration number of the student sitting on that seat.

	Column-1	Column-2	-----	Column-28	Column-29
Row-1	1	2		28	29
Row-2	30	32		57	58
Row-3	59	60		86	87
-					
-					
-					
-					
Row-30	842	843		869	870
Row-31	871	872		898	899

If we observe the above table, we can see every row has consecutive numbers starting from  $29 \times (\text{row} - 1) + 1$ . So, the general term for the above table can be written as  $C_{ij} = 29(i-1)+j$ , where  $C_{ij}$  represents the seat in  $i$  th row and  $j$  th column.

Similarly, sitting arrangement of students during the seminar titled as "Women Empowerment in Informal Sector" is as given below



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	Column-1	Column-2	-----	Column-28	Column-29
Row-1	1	32		838	869
Row-2	2	33		839	870
Row-3	3	34		840	871
-					
-					
-					
Row-30	30	61		867	898
Row-31	31	62		868	899

So, the general term for the above table can be written as  $C_{ij} = 31(j-1)+i$ .

As per the question we can say,

$$29(a-1) + b = 31(a-1) + b$$

$$\text{or, } 2(a-1) = 0$$

$$\text{or, } a=1$$

Therefore, it means that all the students who seat in row 1 in the seminar "Inflation Targeting" will have their row and column number exchanged in seminar "Women Empowerment in Informal Sector"

$$\text{Therefore sum of registration numbers of students in row 1 in seminar "Inflation Targeting" = } 1+2+3+4+\dots+28+29 = \frac{29 \times 30}{2} = 435$$

**28. The registration number of Vishal is the square of a natural number greater than 1. In the seminar "Women Empowerment in Informal Sector" Vishal sits on a seat which is placed in row number r and column number c, where r equals to c. Then find the sum of all possible column numbers of the seats on which Vishal can sit in the seminar "Inflation Targeting"**

**Sol.** Sitting arrangement of students during the seminar titled as "Inflation Targeting" is as given below, where number mentioned in any cell is the registration number of the student sitting on that seat.

	Column-1	Column-2	-----	Column-28	Column-29
Row-1	1	2		28	29
Row-2	30	32		57	58
Row-3	59	60		86	87
-					
-					
-					
Row-30	842	843		869	870
Row-31	871	872		898	899





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If we observe the above table, we can see every row has consecutive numbers starting from  $29 \times (\text{row} - 1) + 1$ .

So, the general term for the above table can be written as  $C_{ij} = 29(i-1)+j$ , where  $C_{ij}$  represents the seat in  $i$  th row and  $j$  th column.

Similarly, sitting arrangement of students during the seminar titled as “Women Empowerment in Informal Sector” is as given below

	Column-1	Column-2	-----	Column-28	Column-29
Row-1	1	32		838	869
Row-2	2	33		839	870
Row-3	3	34		840	871
-					
-					
-					
Row-30	30	61		867	898
Row-31	31	62		868	899

So, the general term for the above table can be written as  $C_{ij} = 31(j-1)+i$ .

In the seminar for "Women Empowerment in Informal Sector" Vishal sits on a seat whose row number is equal to column number. So, let the row number and column number of seat be  $a$ .

Let the registration number of Vishal be  $p^2$

Therefore,  $p^2 = 31(a-1) + a$

or,  $p^2 = 32a - 31$

Since  $p$  is a natural number greater than 1, so the values of  $a$  which satisfy the above equation are 8 and 10.

Note that  $32 \times 8 - 31 = 225$  and  $32 \times 10 - 31 = 289$

So,  $p^2 = 289$  or  $p^2 = 225$

Now in seminar for "Inflation Targeting" let seat of Vishal be in  $i$  th row and  $j$  th column.

For,  $289 = 29(i-1) + j$   $i = 10$  and  $j = 28$

For,  $225 = 29(i-1) + j$   $i = 8$  and  $j = 22$

So, sum of the values is  $28+22 = 50$



Instructions

a				
g			b	c
		d		
	e	f		

1. This cross-number puzzle has exactly one digit in each cell, i.e. it can be any digit from 0 to 9.
2. None of the cells labelled with a, b, c, d, e, and f is zero(0).
3. A family consists of four members, and the data in the cross-number puzzle represents their ages accordingly.

ACROSS

- a. Square of one's age
- b. Son's age
- d. Sum of the ages of 3 members in the family
- e. Product of any two ages
- f. Mother's age
- g. Age of any family member

DOWN

- a. Sum of the ages of two family members multiplied with the age of third member.
- b. Sum of their ages(all family members)
- c. Father's age
- d. Daughter's age

29. What is the sum of values of the cells labelled with a, b, c, d, e,f and g?

- A. 18
- B. 24
- C. 31
- D. 36

Sol.

	A	B
C	D	E
F	G	

Individual ages are AB, BE, CF and FG.  
 Sum of their ages (all family members) = ADG  
 Sum of the ages of any three members = CDE  
 Case 1: CDE + AB = ADG



$$\begin{array}{r} CDE \\ +AB \\ \hline ADG \end{array}$$

A can be 9 or 0. A cannot be 0 as per the given conditions. Therefore, A is 9.  
 Sum of their ages (all family members) = ADG  
 Maximum value A can take is 3. Therefore, this case is invalid.

Case 2: CDE + CF = ADG

$$\begin{array}{r} CDE \\ +CF \\ \hline ADG \end{array}$$

C can be 9 or 0. C cannot be 0 as per the given conditions. Therefore, C is 9.  
 Sum of the ages of any three family members = CDE  
 Maximum value C can take is 2. Therefore, this case is invalid.

Case 3: CDE + FG = ADG

$$\begin{array}{r} CDE \\ +FG \\ \hline ADG \end{array}$$

E = 0. This case is only possible when F = 0, but as per the given conditions F should not be equal to 0. Therefore, this case is invalid.

Case 4: CDE + BE = ADG

$$\begin{array}{r} CDE \\ +BE \\ \hline ADG \end{array}$$

B can be 9 or 0. B cannot be 0 as per the given conditions. Therefore, B is 9.  
 $C + 1 = A$  and  $E > 4$   
 $AB + CF + FG = CDE$   
 a) If A = 3 and C = 2

$$\begin{array}{r} AB \\ CF \\ +FG \\ \hline CDE \end{array}$$

This sum is not possible if C = 2 and A = 3  
 Therefore, C = 1 and A = 2.

It is given,

$$\begin{array}{r} AB \\ BE \\ CF \\ +FG \\ \hline ADG \end{array}$$

This implies B + E + F should end with zero. B = 9 and E + F should be 1 or 11.  
 E + F cannot be 1 as E > 4. Therefore, E + F should be 11.  
 If E + F = 11, minimum sum of A + B + C + F should be 18 such that A = 2



$A + B + C = 2 + 9 + 1 = 12$  and  $E > 4$   
 The only possible case is  $F = 6, E = 5$  and  $G = 0$ .

a				
g			2	9
		1	0	5
	e	6	0	

Therefore, the ages of family members are 16, 29, 60 and 95. It is given that ACROSS a is the square of one of the ages and DOWN a is the sum of ages of two family members multiplied with third family member. The only possibility is ACROSS a is  $60^2$  and DOWN a is  $(95+16)29 = 3219$ .

3	6	0	0	
2				
1			2	9
9		1	0	5
	e	6	0	

It is given, ACROSS e is product of two ages. The only possibility is  $16*60 = 960$  and It is also given that ACROSS g is the age of any family member. It starts with 1, it should be 16. Final arrangement:

3	6	0	0	
2				
1	6		2	9
9		1	0	5
	9	6	0	

Required sum =  $a + b + c + d + e + f + g = 3 + 2 + 9 + 1 + 9 + 6 + 1 = 31$   
 The answer is option C.

**30. What is the average age of the family?**

Enter closest integer and enter -1 if the answer can't be determined.

**Sol.**

		A	B
	C	D	E
	F	G	

Individual ages are AB, BE, CF and FG.  
 Sum of their ages (all family members) = ADG  
 Sum of the ages of any three members = CDE  
 Case 1:  $CDE + AB = ADG$





$$\begin{array}{r} CDE \\ +AB \\ \hline ADG \end{array}$$

A can be 9 or 0. A cannot be 0 as per the given conditions. Therefore, A is 9.  
 Sum of their ages (all family members) = ADG  
 Maximum value A can take is 3. Therefore, this case is invalid.

Case 2: CDE + CF = ADG

$$\begin{array}{r} CDE \\ +CF \\ \hline ADG \end{array}$$

C can be 9 or 0. C cannot be 0 as per the given conditions. Therefore, C is 9.  
 Sum of the ages of any three family members = CDE  
 Maximum value C can take is 2. Therefore, this case is invalid.

Case 3: CDE + FG = ADG

$$\begin{array}{r} CDE \\ +FG \\ \hline ADG \end{array}$$

E = 0. This case is only possible when F = 0, but as per the given conditions F should not be equal to 0. Therefore, this case is invalid.

Case 4: CDE + BE = ADG

$$\begin{array}{r} CDE \\ +BE \\ \hline ADG \end{array}$$

B can be 9 or 0. B cannot be 0 as per the given conditions. Therefore, B is 9.  
 $C + 1 = A$  and  $E > 4$   
 $AB + CF + FG = CDE$   
 a) If A = 3 and C = 2

$$\begin{array}{r} AB \\ CF \\ +FG \\ \hline CDE \end{array}$$

This sum is not possible if C = 2 and A = 3  
 Therefore, C = 1 and A = 2.  
 It is given,

$$\begin{array}{r} AB \\ BE \\ CF \\ +FG \\ \hline ADG \end{array}$$

This implies B + E + F should end with zero. B = 9 and E + F should be 1 or 11.  
 E + F cannot be 1 as E > 4. Therefore, E + F should be 11.  
 If E + F = 11, minimum sum of A + B + C + F should be 18 such that A = 2



$A + B + C = 2 + 9 + 1 = 12$  and  $E > 4$   
 The only possible case is  $F = 6, E = 5$  and  $G = 0$ .

a				
g			2	9
		1	0	5
	e	6	0	

Therefore, the ages of family members are 16, 29, 60 and 95.  
 It is given that ACROSS a is the square of one of the ages and DOWN a is the sum of ages of two family members multiplied with third family member. The only possibility is ACROSS a is  $60^2$  and DOWN a is  $(95+16)29 = 3219$ .

3	6	0	0	
2				
1			2	9
9		1	0	5
	e	6	0	

It is given, ACROSS e is product of two ages. The only possibility is  $16*60 = 960$  and It is also given that ACROSS g is the age of any family member. It starts with 1, it should be 16.  
 Final arrangement:

3	6	0	0	
2				
1	6		2	9
9		1	0	5
	9	6	0	

Sum of their ages = 200  
 Average age =  $200/4 = 50$   
 The answer is 50.

**31. Which digit has appeared in the maximum number of cells?**

Sol.

		A	B
	C	D	E
	F	G	

Individual ages are AB, BE, CF and FG.  
 Sum of their ages (all family members) = ADG  
 Sum of the ages of any three members = CDE  
 Case 1:  $CDE + AB = ADG$



$$\begin{array}{r} CDE \\ +AB \\ \hline ADG \end{array}$$

A can be 9 or 0. A cannot be 0 as per the given conditions. Therefore, A is 9.  
 Sum of their ages (all family members) = ADG  
 Maximum value A can take is 3. Therefore, this case is invalid.

Case 2: CDE + CF = ADG

$$\begin{array}{r} CDE \\ +CF \\ \hline ADG \end{array}$$

C can be 9 or 0. C cannot be 0 as per the given conditions. Therefore, C is 9.  
 Sum of the ages of any three family members = CDE  
 Maximum value C can take is 2. Therefore, this case is invalid.

Case 3: CDE + FG = ADG

$$\begin{array}{r} CDE \\ +FG \\ \hline ADG \end{array}$$

E = 0. This case is only possible when F = 0, but as per the given conditions F should not be equal to 0. Therefore, this case is invalid.

Case 4: CDE + BE = ADG

$$\begin{array}{r} CDE \\ +BE \\ \hline ADG \end{array}$$

B can be 9 or 0. B cannot be 0 as per the given conditions. Therefore, B is 9.  
 $C + 1 = A$  and  $E > 4$   
 $AB + CF + FG = CDE$   
 a) If A = 3 and C = 2

$$\begin{array}{r} AB \\ CF \\ +FG \\ \hline CDE \end{array}$$

This sum is not possible if C = 2 and A = 3  
 Therefore, C = 1 and A = 2.

It is given,

$$\begin{array}{r} AB \\ BE \\ CF \\ +FG \\ \hline ADG \end{array}$$

This implies B + E + F should end with zero. B = 9 and E + F should be 1 or 11.  
 E + F cannot be 1 as E > 4. Therefore, E + F should be 11.  
 If E + F = 11, minimum sum of A + B + C + F should be 18 such that A = 2



$A + B + C = 2 + 9 + 1 = 12$  and  $E > 4$   
 The only possible case is  $F = 6, E = 5$  and  $G = 0$ .

a				
g			2	9
		1	0	5
	e	6	0	

Therefore, the ages of family members are 16, 29, 60 and 95.  
 It is given that ACROSS a is the square of one of the ages and DOWN a is the sum of ages of two family members multiplied with third family member. The only possibility is ACROSS a is  $60^2$  and DOWN a is  $(95+16)29 = 3219$ .

3	6	0	0	
2				
1			2	9
9		1	0	5
	e	6	0	

It is given, ACROSS e is product of two ages. The only possibility is  $16*60 = 960$  and It is also given that ACROSS g is the age of any family member. It starts with 1, it should be 16.  
 Final arrangement:

3	6	0	0	
2				
1	6		2	9
9		1	0	5
	9	6	0	

'0' appeared four times, i.e. in maximum number of cells.  
 The answer is 0.

**32. What is the sum of parents' ages when their son was born?**

- A. 87
- B. 101
- C. 121
- D. 97

**Sol.**

		A	B
	C	D	E
	F	G	





Individual ages are AB, BE, CF and FG.

Sum of their ages (all family members) = ADG

Sum of the ages of any three members = CDE

Case 1: CDE + AB = ADG

$$\begin{array}{r} CDE \\ + AB \\ \hline ADG \end{array}$$

A can be 9 or 0. A cannot be 0 as per the given conditions. Therefore, A is 9.

Sum of their ages (all family members) = ADG

Maximum value A can take is 3. Therefore, this case is invalid.

Case 2: CDE + CF = ADG

$$\begin{array}{r} CDE \\ + CF \\ \hline ADG \end{array}$$

C can be 9 or 0. C cannot be 0 as per the given conditions. Therefore, C is 9.

Sum of the ages of any three family members = CDE

Maximum value C can take is 2. Therefore, this case is invalid.

Case 3: CDE + FG = ADG

$$\begin{array}{r} CDE \\ + FG \\ \hline ADG \end{array}$$

E = 0. This case is only possible when F = 0, but as per the given conditions F should not be equal to 0. Therefore, this case is invalid.

Case 4: CDE + BE = ADG

$$\begin{array}{r} CDE \\ + BE \\ \hline ADG \end{array}$$

B can be 9 or 0. B cannot be 0 as per the given conditions. Therefore, B is 9.

C + 1 = A and E > 4

AB + CF + FG = CDE

a) If A = 3 and C = 2

$$\begin{array}{r} AB \\ CF \\ + FG \\ \hline CDE \end{array}$$

This sum is not possible if C = 2 and A = 3

Therefore, C = 1 and A = 2.

It is given,



$$\begin{array}{r}
 AB \\
 BE \\
 CF \\
 +FG \\
 \hline
 ADG
 \end{array}$$

This implies  $B + E + F$  should end with zero.  $B = 9$  and  $E + F$  should be 1 or 11.  
 $E + F$  cannot be 1 as  $E > 4$ . Therefore,  $E + F$  should be 11.  
 If  $E + F = 11$ , minimum sum of  $A + B + C + F$  should be 18 such that  $A = 2$   
 $A + B + C = 2 + 9 + 1 = 12$  and  $E > 4$   
 The only possible case is  $F = 6, E = 5$  and  $G = 0$ .

a				
g			2	9
		1	0	5
	e	6	0	

Therefore, the ages of family members are 16, 29, 60 and 95.  
 It is given that ACROSS a is the square of one of the ages and DOWN a is the sum of ages of two family members multiplied with third family member. The only possibility is ACROSS a is  $60^2$  and DOWN a is  $(95+16)29 = 3219$ .

3	6	0	0	
2				
1			2	9
9		1	0	5
	e	6	0	

It is given, ACROSS e is product of two ages. The only possibility is  $16*60 = 960$  and It is also given that ACROSS g is the age of any family member. It starts with 1, it should be 16.  
 Final arrangement:

3	6	0	0	
2				
1	6		2	9
9		1	0	5
	9	6	0	

Father's age = 95, Mother's age = 60, Son's age = 29, and Daughter's age = 16  
 Sum of parent's age when son was born =  $95 - 29 + 60 - 29 = 97$   
 The answer is option D.

**33. What is the difference between the numbers formed ACROSS a and DOWN a?**

- A. 381
- B. 291
- C. 361
- D. 261



		A	B
	C	D	E
	F	G	

Sol.

Individual ages are AB, BE, CF and FG.

Sum of their ages (all family members) = ADG

Sum of the ages of any three members = CDE

Case 1:  $CDE + AB = ADG$

$$\begin{array}{r} CDE \\ + AB \\ \hline ADG \end{array}$$

A can be 9 or 0. A cannot be 0 as per the given conditions. Therefore, A is 9.

Sum of their ages (all family members) = ADG

Maximum value A can take is 3. Therefore, this case is invalid.

Case 2:  $CDE + CF = ADG$

$$\begin{array}{r} CDE \\ + CF \\ \hline ADG \end{array}$$

C can be 9 or 0. C cannot be 0 as per the given conditions. Therefore, C is 9.

Sum of the ages of any three family members = CDE

Maximum value C can take is 2. Therefore, this case is invalid.

Case 3:  $CDE + FG = ADG$

$$\begin{array}{r} CDE \\ + FG \\ \hline ADG \end{array}$$

$E = 0$ . This case is only possible when  $F = 0$ , but as per the given conditions F should not be equal to 0. Therefore, this case is invalid.

Case 4:  $CDE + BE = ADG$

$$\begin{array}{r} CDE \\ + BE \\ \hline ADG \end{array}$$

B can be 9 or 0. B cannot be 0 as per the given conditions. Therefore, B is 9.

$C + 1 = A$  and  $E > 4$

$AB + CF + FG = CDE$

a) If  $A = 3$  and  $C = 2$

$$\begin{array}{r} AB \\ CF \\ + FG \\ \hline CDE \end{array}$$



This sum is not possible if  $C = 2$  and  $A = 3$   
 Therefore,  $C = 1$  and  $A = 2$ .

It is given,

$$\begin{array}{r} AB \\ BE \\ CF \\ +FG \\ \hline ADG \end{array}$$

This implies  $B + E + F$  should end with zero.  $B = 9$  and  $E + F$  should be 1 or 11.  
 $E + F$  cannot be 1 as  $E > 4$ . Therefore,  $E + F$  should be 11.  
 If  $E + F = 11$ , minimum sum of  $A + B + C + F$  should be 18 such that  $A = 2$   
 $A + B + C = 2 + 9 + 1 = 12$  and  $E > 4$   
 The only possible case is  $F = 6, E = 5$  and  $G = 0$ .

a				
g			2	9
		1	0	5
	e	6	0	

Therefore, the ages of family members are 16, 29, 60 and 95.  
 It is given that ACROSS a is the square of one of the ages and DOWN a is the sum of ages of two family members multiplied with third family member. The only possibility is ACROSS a is  $60^2$  and DOWN a is  $(95+16)29 = 3219$ .

3	6	0	0	
2				
1			2	9
9		1	0	5
	e	6	0	

It is given, ACROSS e is product of two ages. The only possibility is  $16*60 = 960$  and It is also given that ACROSS g is the age of any family member. It starts with 1, it should be 16.

Final arrangement:

3	6	0	0	
2				
1	6		2	9
9		1	0	5
	9	6	0	

ACROSS a = 3600  
 DOWN a = 3219  
 Required difference =  $3600 - 3219 = 381$   
 The answer is option A.





34. What is the sum of values of all the cells?

Enter -1 if the answer can't be determined.

		A	B
	C	D	E
	F	G	

Sol.

Individual ages are AB, BE, CF and FG.  
 Sum of their ages (all family members) = ADG  
 Sum of the ages of any three members = CDE  
 Case 1: CDE + AB = ADG

$$\begin{array}{r} CDE \\ + AB \\ \hline ADG \end{array}$$

A can be 9 or 0. A cannot be 0 as per the given conditions. Therefore, A is 9.  
 Sum of their ages (all family members) = ADG  
 Maximum value A can take is 3. Therefore, this case is invalid.

Case 2: CDE + CF = ADG

$$\begin{array}{r} CDE \\ + CF \\ \hline ADG \end{array}$$

C can be 9 or 0. C cannot be 0 as per the given conditions. Therefore, C is 9.  
 Sum of the ages of any three family members = CDE  
 Maximum value C can take is 2. Therefore, this case is invalid.

Case 3: CDE + FG = ADG

$$\begin{array}{r} CDE \\ + FG \\ \hline ADG \end{array}$$

E = 0. This case is only possible when F = 0, but as per the given conditions F should not be equal to 0. Therefore, this case is invalid.

Case 4: CDE + BE = ADG

$$\begin{array}{r} CDE \\ + BE \\ \hline ADG \end{array}$$

B can be 9 or 0. B cannot be 0 as per the given conditions. Therefore, B is 9.  
 C + 1 = A and E > 4  
 AB + CF + FG = CDE  
 a) If A = 3 and C = 2



$$\begin{array}{r} AB \\ CF \\ +FG \\ \hline CDE \end{array}$$

This sum is not possible if  $C = 2$  and  $A = 3$   
Therefore,  $C = 1$  and  $A = 2$ .

It is given,

$$\begin{array}{r} AB \\ BE \\ CF \\ +FG \\ \hline ADG \end{array}$$

This implies  $B + E + F$  should end with zero.  $B = 9$  and  $E + F$  should be 1 or 11.

$E + F$  cannot be 1 as  $E > 4$ . Therefore,  $E + F$  should be 11.

If  $E + F = 11$ , minimum sum of  $A + B + C + F$  should be 18 such that  $A = 2$

$A + B + C = 2 + 9 + 1 = 12$  and  $E > 4$

The only possible case is  $F = 6$ ,  $E = 5$  and  $G = 0$ .

a				
g			2	9
		1	0	5
	e	6	0	

Therefore, the ages of family members are 16, 29, 60 and 95.

It is given that ACROSS a is the square of one of the ages and DOWN a is the sum of ages of two family members multiplied with third family member. The only possibility is ACROSS a is  $60^2$  and DOWN a is  $(95+16)29 = 3219$ .

3	6	0	0	
2				
1			2	9
9		1	0	5
	e	6	0	

It is given, ACROSS e is product of two ages. The only possibility is  $16*60 = 960$  and It is also given that ACROSS g is the age of any family member. It starts with 1, it should be 16.

Final arrangement:

3	6	0	0	
2				
1	6		2	9
9		1	0	5
	9	6	0	

Required sum =  $3 + 6 + 2 + 1 + 6 + 2 + 9 + 9 + 1 + 5 + 9 + 6 = 59$

The answer is 59.



Instructions

A 24 hours clock is a clock which has 24 hours on the clock face instead of the usual 12 hours. The second hand completes a full rotation in a minute, the minute hand in an hour and the hour hand in 24 hours. Answer the following questions considering the clock to be a 24 hours clock.

**35. What is the smaller angle between the minute and hour hand of the clock at 16:50?**

- A. 47.5
- B. 72.5
- C. 37.5
- D. 120

**Sol.** Since the clock is numbered from 1 – 24, these 24 slots cover  $360^\circ$ .

Thus, the space between each number =  $\frac{360}{24} = 15^\circ$ .

The hour hand moves from one number to another in an hour. Thus, the speed of hour hand =  $15^\circ/\text{hour} = 0.25^\circ/\text{minute}$ .

The minute hand covers  $360^\circ$  in an hour. Thus, the speed of the minute hand  $\frac{360}{60} = 6^\circ/\text{minute}$ .

Thus, the relative speed of the hour and minute hand =  $6 - 0.25 = 5.75^\circ/\text{minute}$ .

At 16 O'clock, the angle between both the hands =  $16 \times 15 = 240^\circ$ .

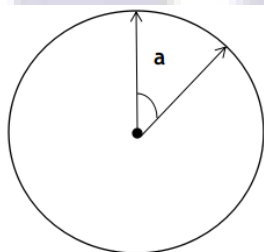
Now, in 50 minutes, the minute hand will reduce the angle by  $5.75 \times 50 = 287.5^\circ$

Thus, the angle between minute hand and hour hand will be =  $287.5^\circ - 240^\circ = 47.5^\circ$

**36. In a day, what is the percentage of time for which both the angles between the second and minute hand are greater than 90 degree?**

- A. 50%
- B. 25%
- C. 51%
- D. 60%

**Sol.**





Let the initial angle made by the minute hand and the second hand be  $a^\circ$ . Their reflex angle will be  $(360 - a)^\circ$ .

For the angles to be greater than  $90^\circ$ , in every rotation,

$$a > 90^\circ, \text{ and } 360^\circ - a > 90^\circ$$

$$\text{Or } 90^\circ < a < 270^\circ.$$

$$\text{Range of } a \text{ in each rotation} = 270^\circ - 90^\circ = 180^\circ$$

$$\text{Total angle made by minute hand in one hour} = 360^\circ$$

$$\text{Thus, the required percentage} = \frac{180^\circ}{360^\circ} \times 100 = 50\%$$

**37. At approximately what time between 3 and 4'o clock will the angle between the hours and minute hands be 90 degrees?**

- A. 3:00
- B. 3:23
- C. 3:30
- D. 3:32

**Sol.** Since the clock is numbered from 1 – 12, these 12 slots cover  $360^\circ$ .

$$\text{Thus, the space between each number} = \frac{360}{12} = 30^\circ.$$

The hour hand moves from one number to another in an hour. Thus, the speed of hour hand =  $30^\circ/\text{hour} = 0.5^\circ/\text{minute}$ .

The minute hand covers  $360^\circ$  in an hour. Thus, the speed of the minute hand =  $\frac{360}{60} = 6^\circ/\text{minute}$ .

Thus, the relative speed of the hour and minute hand =  $6 - 0.5 = 5.5^\circ/\text{minute}$ .

At 3 O'clock, the angle between both the hands =  $3 \times 30 = 90^\circ$ .

To get a  $90^\circ$  angle between the two hands, the minute hand will first overtake the hour hand by covering  $90^\circ$  and then travel  $90^\circ$ , i.e., a total of =  $90 + 90 = 180^\circ$

$$\text{Thus, the time required to get a } 90^\circ \text{ angle between the two hands} = \frac{180}{5.5} = 32.72 \approx 33 \text{ minutes.}$$

Thus, the hour hand and the minute hand will have a  $90^\circ$  angle between them at 3 : 33

Hence, the answer is option B.

**38. Due to low battery, it is observed that the clock is losing 8 seconds in a minute. The clock is set to show the correct time at 12:00 AM on Sunday. What will be the day and time when the clock shows correct time again?**

- A. Wednesday 6:00 PM
- B. Saturday 6:00 AM
- C. Monday 12:00 AM
- D. Sunday 12:00 PM





**Sol.** Since the clock loses 8 seconds in a minute, it will lose 8 minutes in an hour.

For the clock to show the correct time again, the clock will have to lose 24 hours.

Thus, the number of hours after which the clock will show the correct time again =  $\frac{24 \times 60}{8} = 180$  hours.

Now, 180 hours =  $24 \times 7 + 12$ , i.e., 7 day and 12 hours.

Thus, the clock will show the same time the next Sunday at 12 PM.

Hence, the answer is option D.

### Instructions

#### Hexagonal Carrom :

**Rules:** 6 players play a Hexagonal Carrom match in which every player will sit at the centre of each side. Two players share each pocket of the board. There are six coins of different colors viz Violet, Indigo, Blue, Green, Yellow, and Red. Each player has to pocket their respective target (the coin of a particular color), and rankings are rewarded on the order of their pocket (i.e. target completion).

**Game:** A, B, C, D, E, F belonging to Australia, Belgium, Canada, Denmark, England, and France are playing the game.

The following information is known about their seating order, their nationality, their rankings and the coin they pocketed:

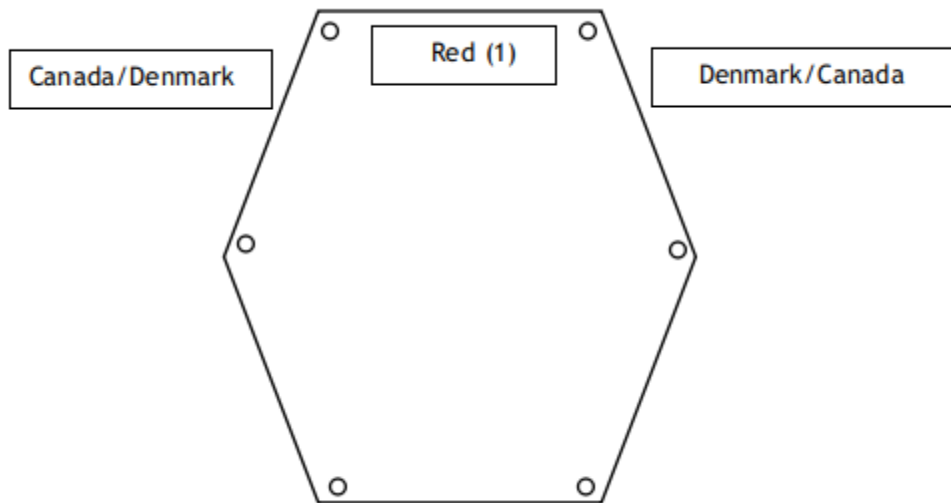
1. The player who pocketed the Red coin came in the first place.
2. E share pockets with A and D, one of them is from Canada, and the other has pocketed a blue coin, and neither came first.
3. The player who pocketed the green coin came second.
4. The player from Belgium and the player from England share a positive difference of 3 rankings in that order. For example, if Belgium is ranked 4, England will be 1, but the converse is not true.
5. The player in the pole position (rank 1) shares pockets with the players from Denmark and Canada.
6. The players who shared the maximum difference in rankings sit opposite each other.
7. The player belonging to Australia came at last, and the player from Denmark was sitting to the immediate right of the person who pocketed the green coin.
8. C, who belongs to France, sits opposite D and has one better rank than F, who has a better rank than E.



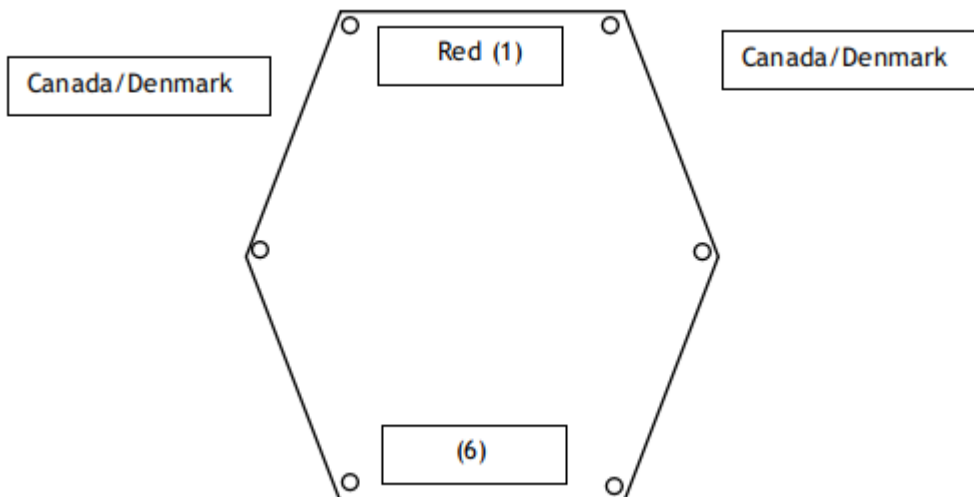
39. After forming all the possible cases, Ram found out the sum of the ranks of each player. Who among the following will have the least summation?

- A. C
- B. A
- C. F
- D. B

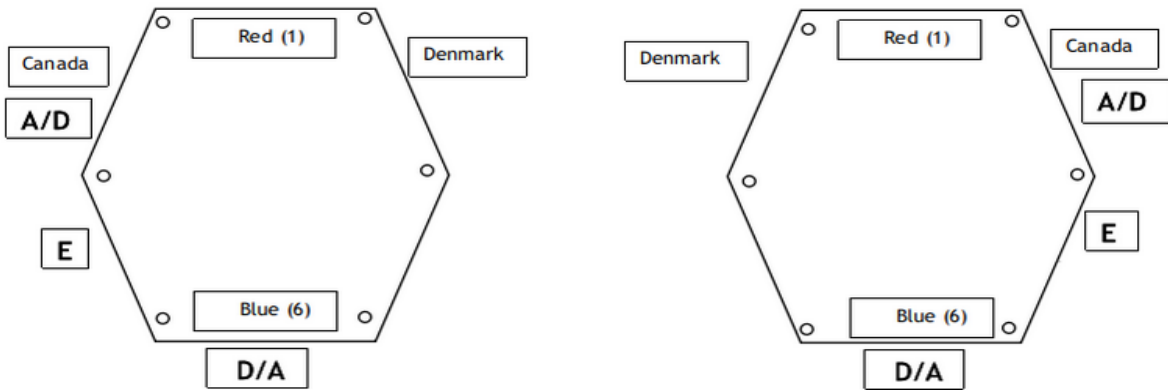
**Sol.** In statement 1, it is given that the Red coin was pocketed for the first place, and statement 4 mentions the neighbours of Rank 1 players are from Denmark and Canada in any order.



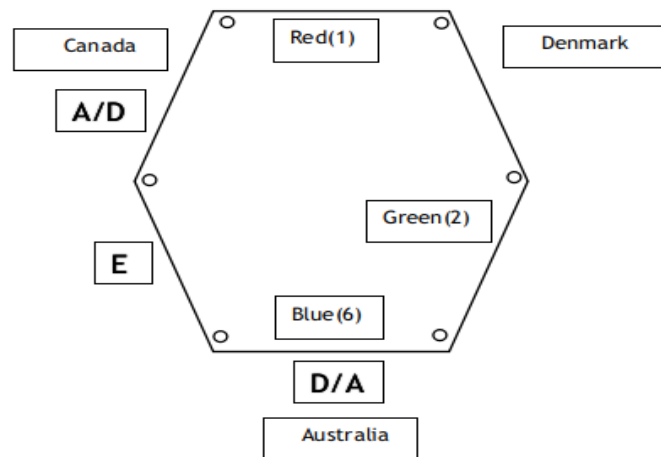
From statement 6, we can say that Rank 1 and 6 are sitting opposite each other (maximum differences in ranking, i.e. 5)



From statement 2, it is clear that the player at 6th place pocketed a blue coin as E is sitting between the player from Canada and the blue coin and from statement 8, we can infer that E cannot be ranked 1, so the arrangements possible are:

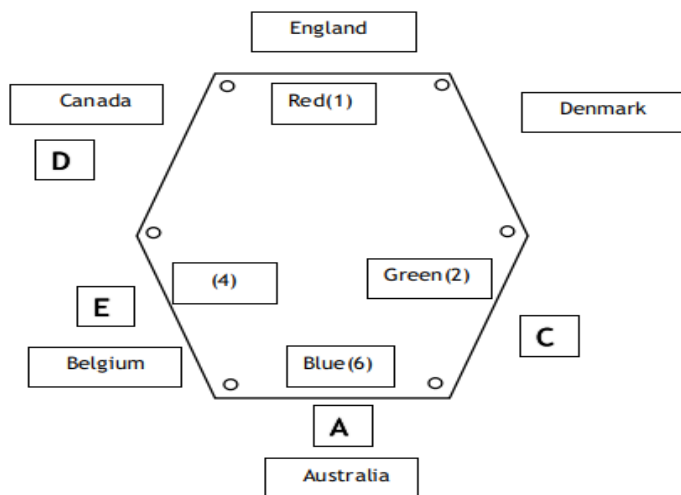


In statement 3, it is mentioned that the player ranked 3 pocketed a green coin, and from statement 7, we get the country of 6th rank player as Australia, and since Denmark player is sitting to the right of the player who pocketed the green coin, we will be able to eliminate one case, and now the case left is:

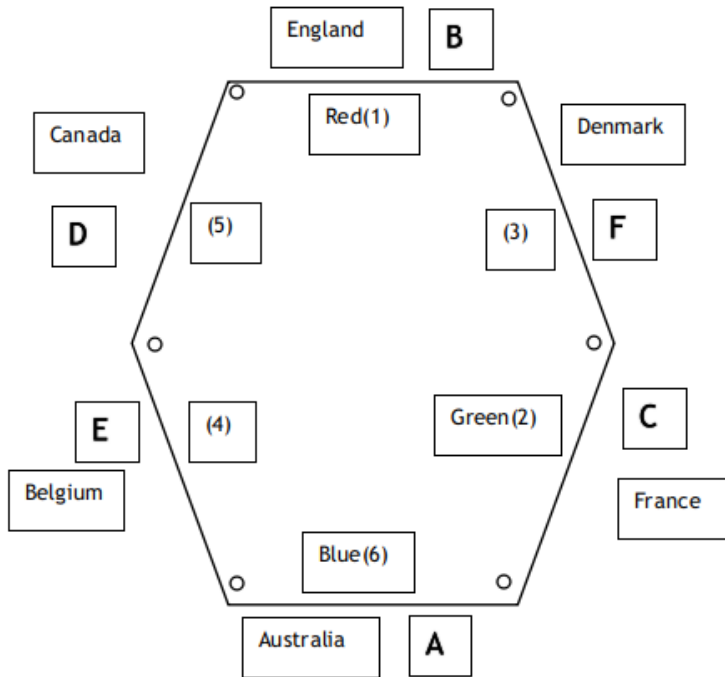


Now, let us consider two cases:

**Case 1:** A pocketed Blue coin and D will belong to Canada. Thus, C will sit to A's right, and C will be opposite D(mentioned in statement 8). Also, since only England and Belgium are remaining, E will be Belgium with rank 4 and England player rank will be 1(as mentioned in statement 4).



Statement 8 mentions the ranking order of C, F, E, i.e.  $C > F > E$ .  
 Since E is 4, F will be 3, and C will be 2.  
 So since F can't be rank 1, B will be rank 1.

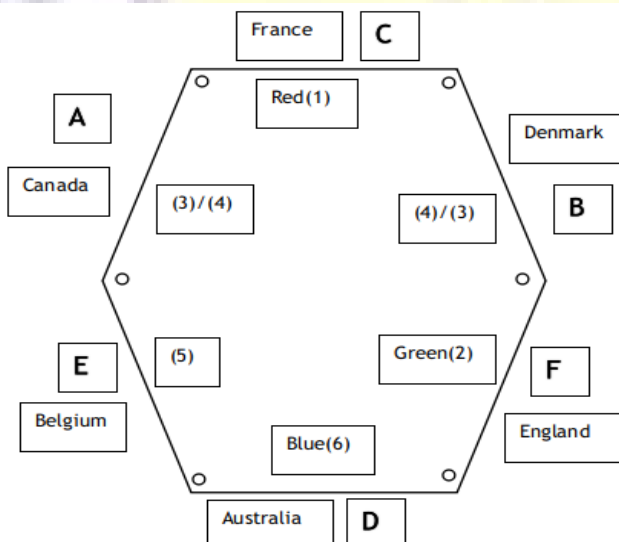


**Case 2:** D has a blue coin, and A is from Canada.

Thus C will be opposite D and will have a red coin.

The only difference of 3 between rankings is 2,5, and since F has one rank more than C, therefore, E will have 5<sup>th</sup> rank and F will have 2<sup>nd</sup>, and they will be from countries Belgium and England respectively.

Now left B will be from Denmark.



So in total, two seating arrangements are possible.

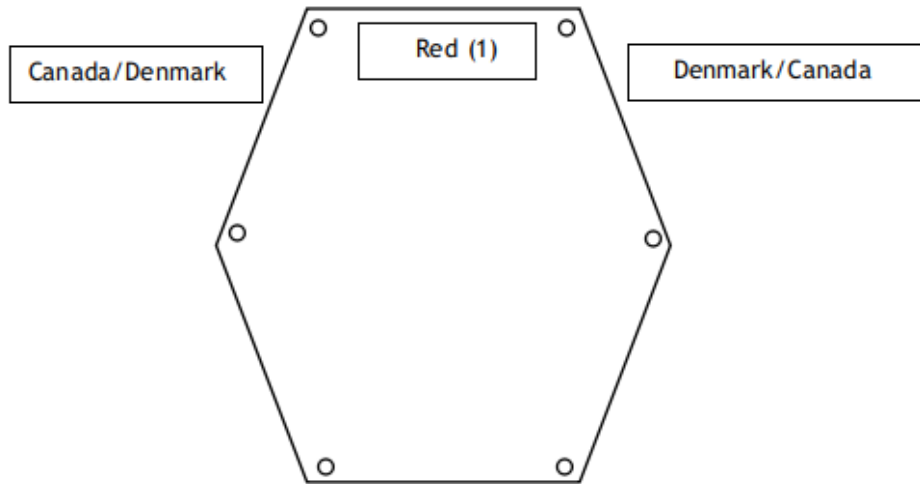
From the above seating arrangements, it is clear that C will have the least summation as C only secured first and second positions in cases 1 and 2.

Hence the correct option will be A.

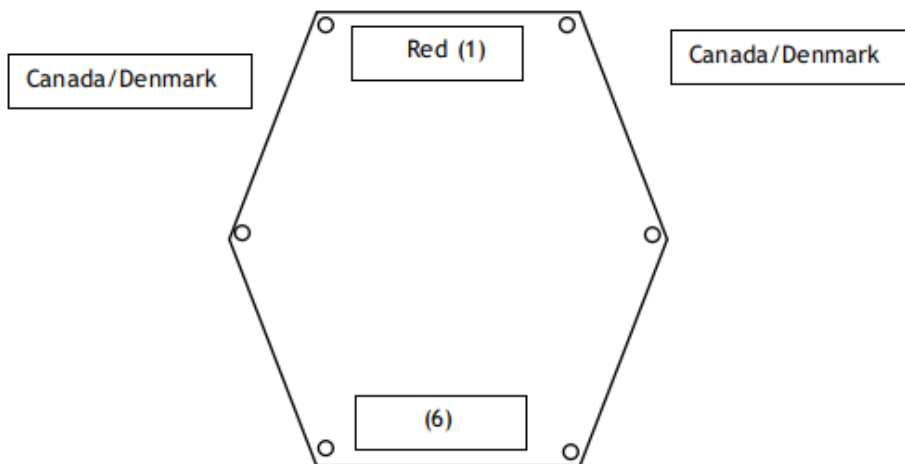
40. Which of the following color coins can D pocket?

- A. Green, Violet, Indigo, Yellow.
- B. Violet, Red, Indigo, Green.
- C. Violet, Indigo, Red, Blue.
- D. Blue, Violet, Indigo, Yellow.

**Sol.** In statement 1, it is given that the Red coin was pocketed for the first place, and statement 4 mentions the neighbours of Rank 1 players are from Denmark and Canada in any order.

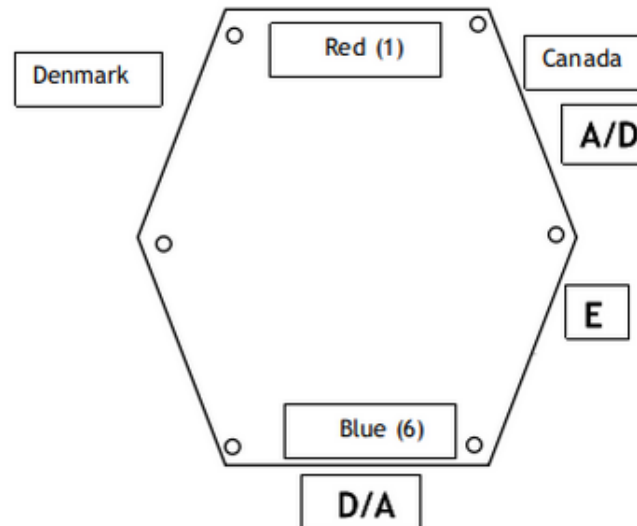
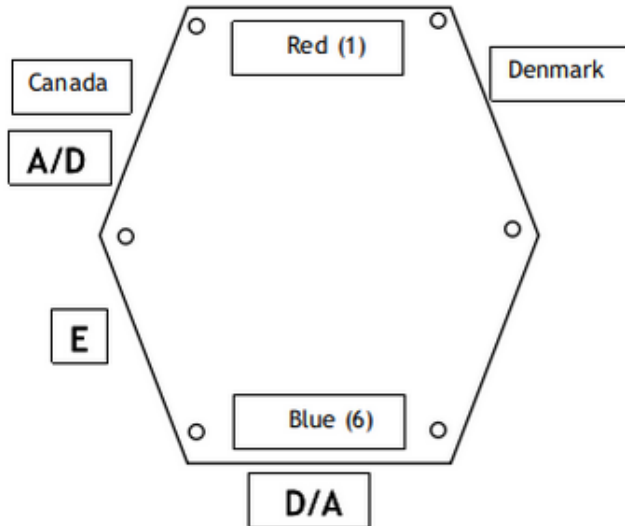


From statement 6, we can say that Rank 1 and 6 are sitting opposite each other (maximum differences in ranking, i.e. 5)

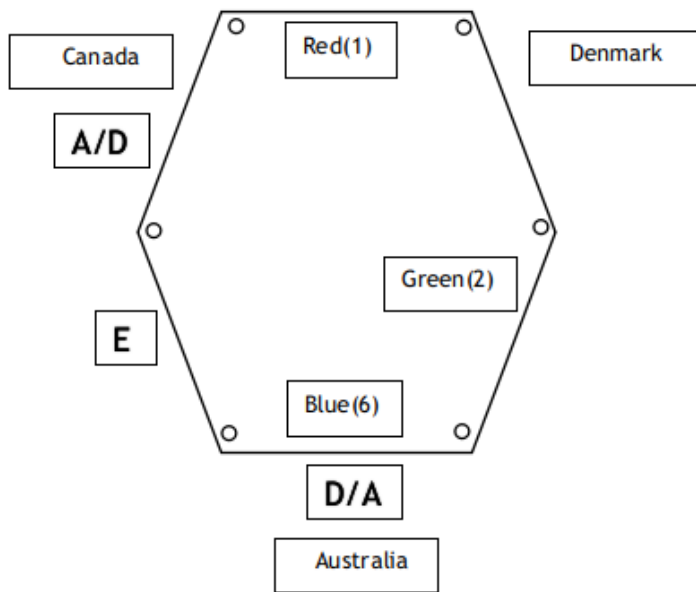


From statement 2, it is clear that the player at 6th place pocketed a blue coin as E is sitting between the player from Canada and the blue coin and from statement 8, we can infer that E cannot be ranked 1, so the arrangements possible are:



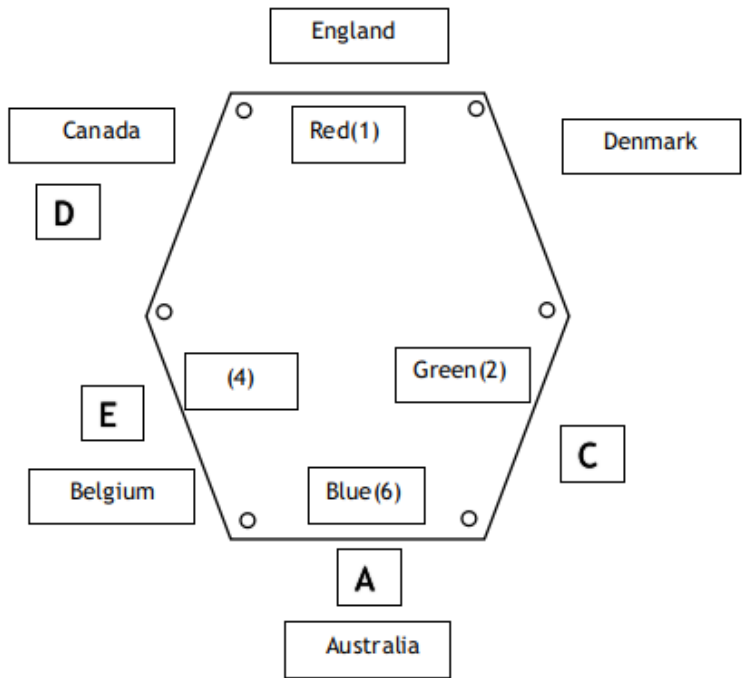


In statement 3, it is mentioned that the player ranked 3 pocketed a green coin, and from statement 7, we get the country of 6th rank player as Australia, and since Denmark player is sitting to the right of the player who pocketed the green coin, we will be able to eliminate one case, and now the case left is:

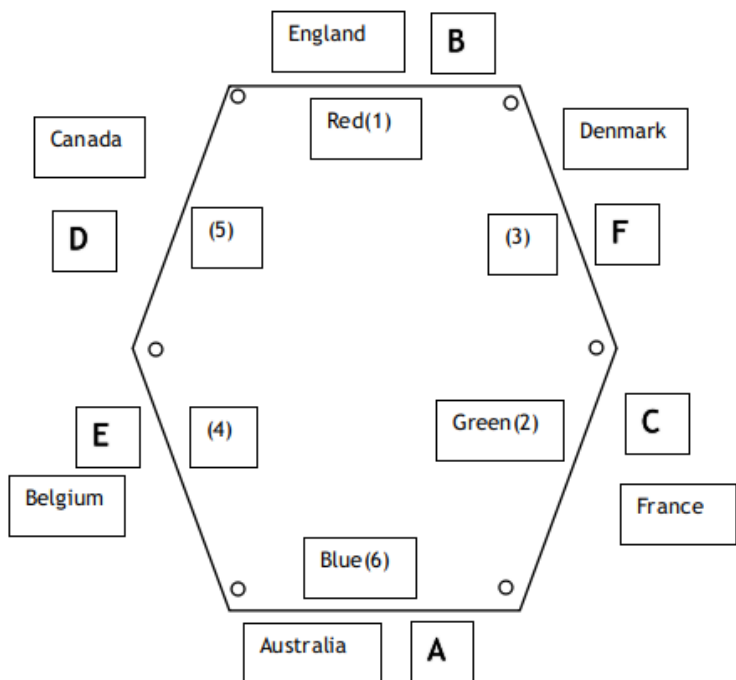


Now, let us consider two cases:

**Case 1:** A pocketed Blue coin and D will belong to Canada. Thus, C will sit to A's right, and C will be opposite D(mentioned in statement 8). Also, since only England and Belgium are remaining, E will be Belgium with rank 4 and England player rank will be 1(as mentioned in statement 4).



Statement 8 mentions the ranking order of C, F, E, i.e.  $C > F > E$ .  
 Since E is 4, F will be 3, and C will be 2.  
 So since F can't be rank 1, B will be rank 1.

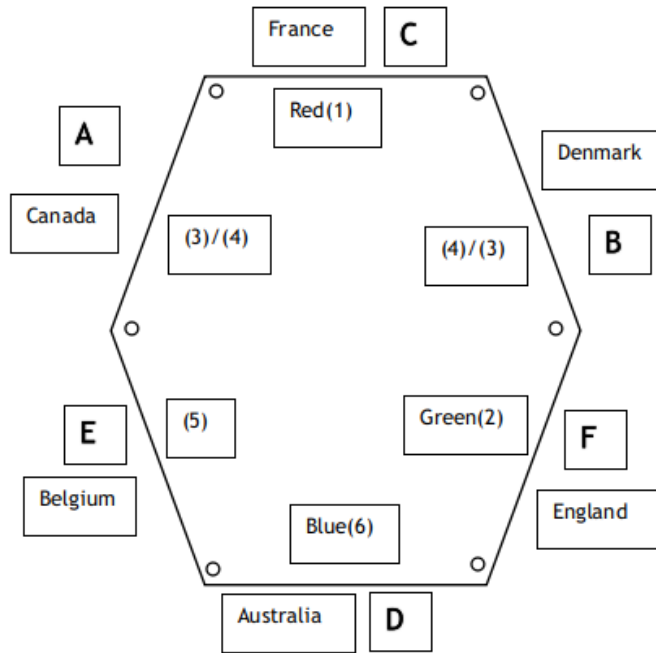


**Case 2:** D has a blue coin, and A is from Canada.

Thus C will be opposite D and will have a red coin.

The only difference of 3 between rankings is 2,5, and since F has one rank more than C, therefore, E will have 5<sup>th</sup> rank and F will have 2<sup>nd</sup>, and they will be from countries Belgium and England respectively.

Now left B will be from Denmark.



So in total, 2 seating arrangements are possible.

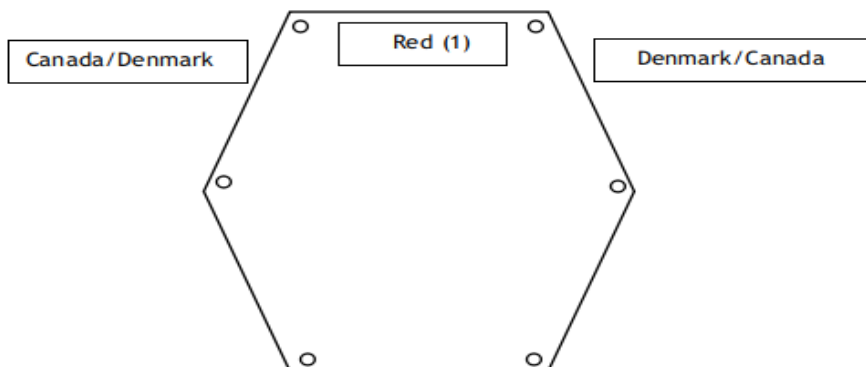
In case 1, D can pocket anyone among Violet, Indigo and Yellow colour coins and in case 2, D pocketed Blue.

Thus the correct choice will be D.

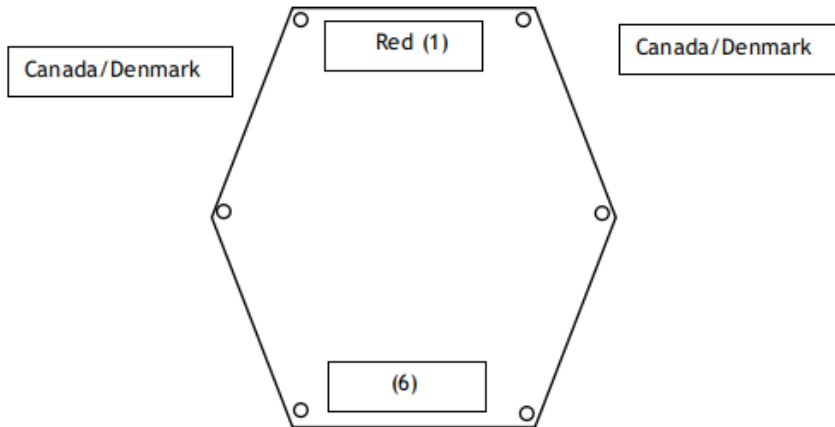
**41. How many ranks can A score?**

- A. 3
- B. 2
- C. 1
- D. 4

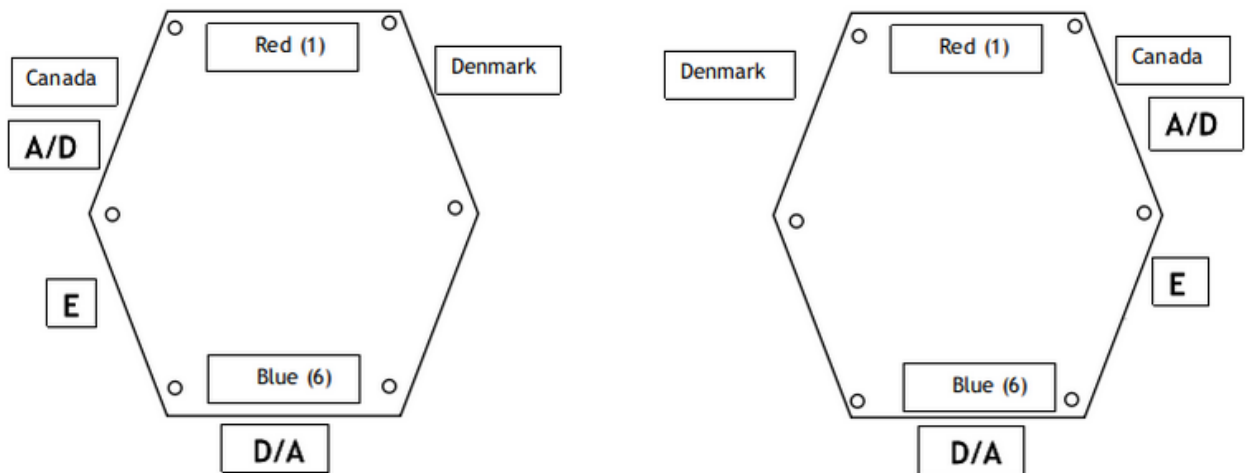
**Sol.** In statement 1, it is given that the Red coin was pocketed for the first place, and statement 4 mentions the neighbours of Rank 1 players are from Denmark and Canada in any order.



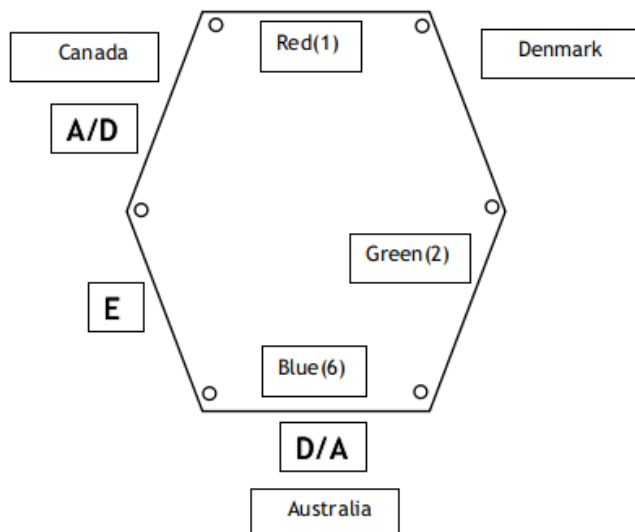
From statement 6, we can say that Rank 1 and 6 are sitting opposite each other (maximum differences in ranking, i.e. 5)



From statement 2, it is clear that the player at 6th place pocketed a blue coin as E is sitting between the player from Canada and the blue coin and from statement 8, we can infer that E cannot be ranked 1, so the arrangements possible are:

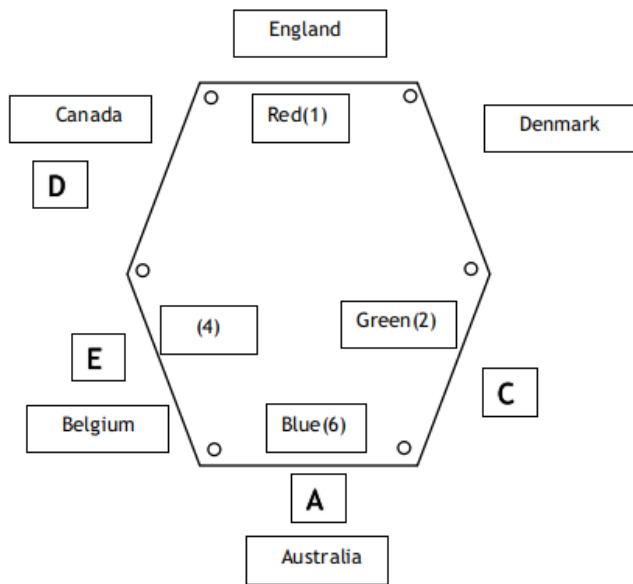


In statement 3, it is mentioned that the player ranked 3 pocketed a green coin, and from statement 7, we get the country of 6th rank player as Australia, and since Denmark player is sitting to the right of the player who pocketed the green coin, we will be able to eliminate one case, and now the case left is:

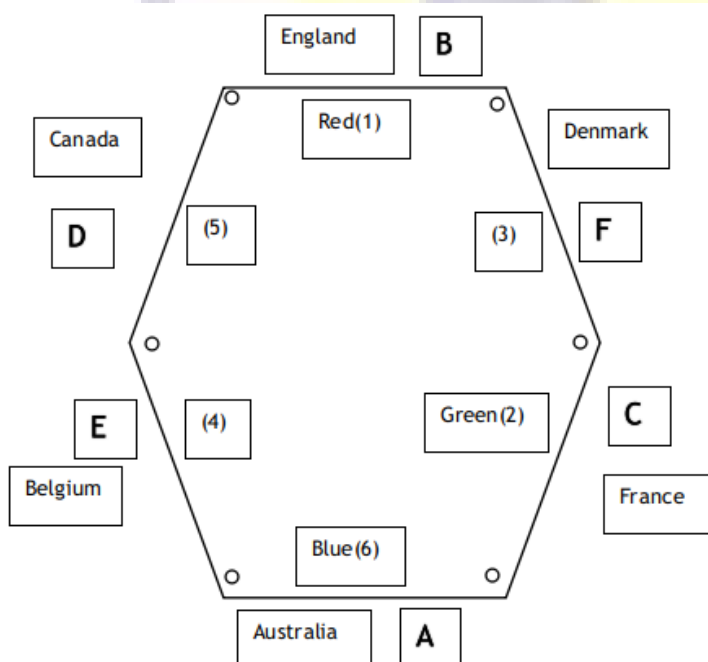


Now, let us consider two cases:

**Case 1:** A pocketed Blue coin and D will belong to Canada. Thus, C will sit to A's right, and C will be opposite D(mentioned in statement 8). Also, since only England and Belgium are remaining, E will be Belgium with rank 4 and England player rank will be 1(as mentioned in statement 4).



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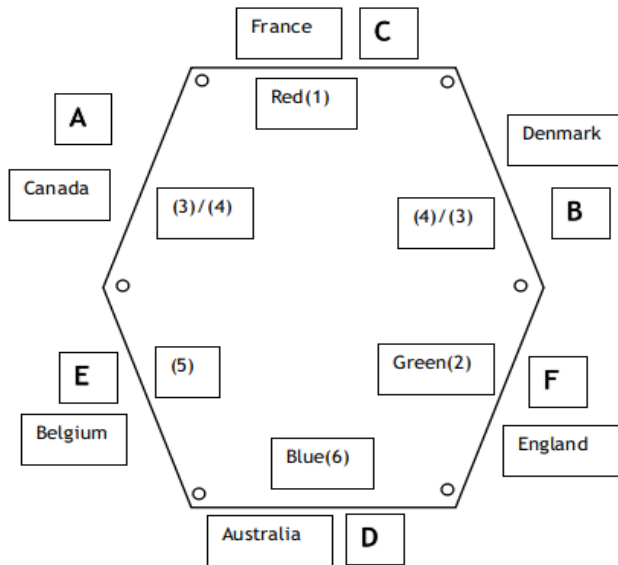


**Case 2:** D has a blue coin, and A is from Canada. Thus C will be opposite D and will have a red coin.



The only difference of 3 between rankings is 2,5, and since F has one rank more than C, therefore, E will have 5<sup>th</sup> rank and F will have 2<sup>nd</sup>, and they will be from countries Belgium and England respectively.

Now left B will be from Denmark.



So in total, 2 seating arrangements are possible.

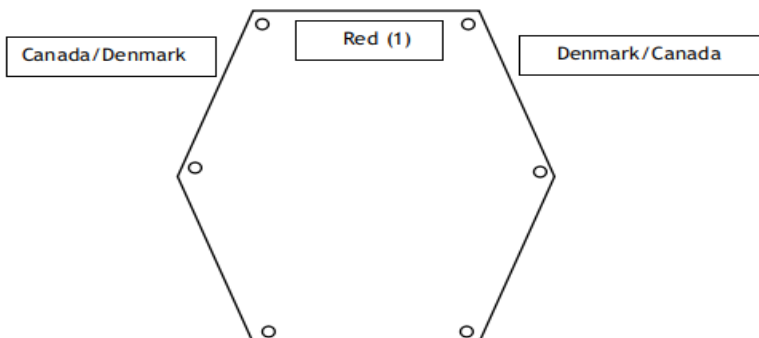
From the above 2 cases, it is evident that A can score in the 3rd, 4th or 6th ranks.

Hence the correct option will be A.

**42. If B belongs to Denmark, what will be the color of the coin F pocketed?**

- A. Indigo
- B. Violet
- C. Yellow
- D. Green

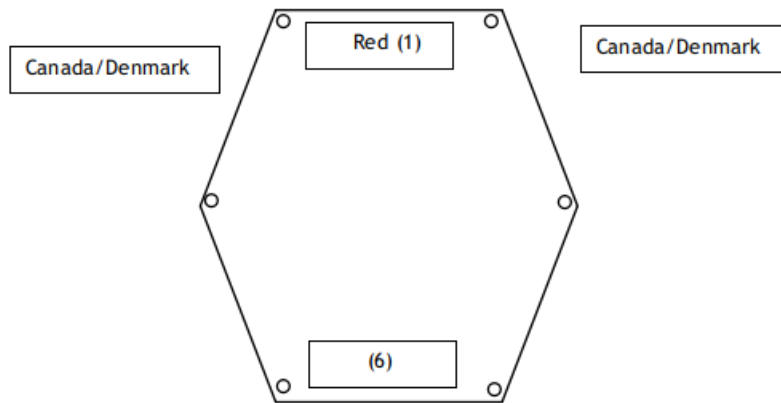
**Sol.** In statement 1, it is given that the Red coin was pocketed for the first place, and statement 4 mentions the neighbours of Rank 1 players are from Denmark and Canada in any order.



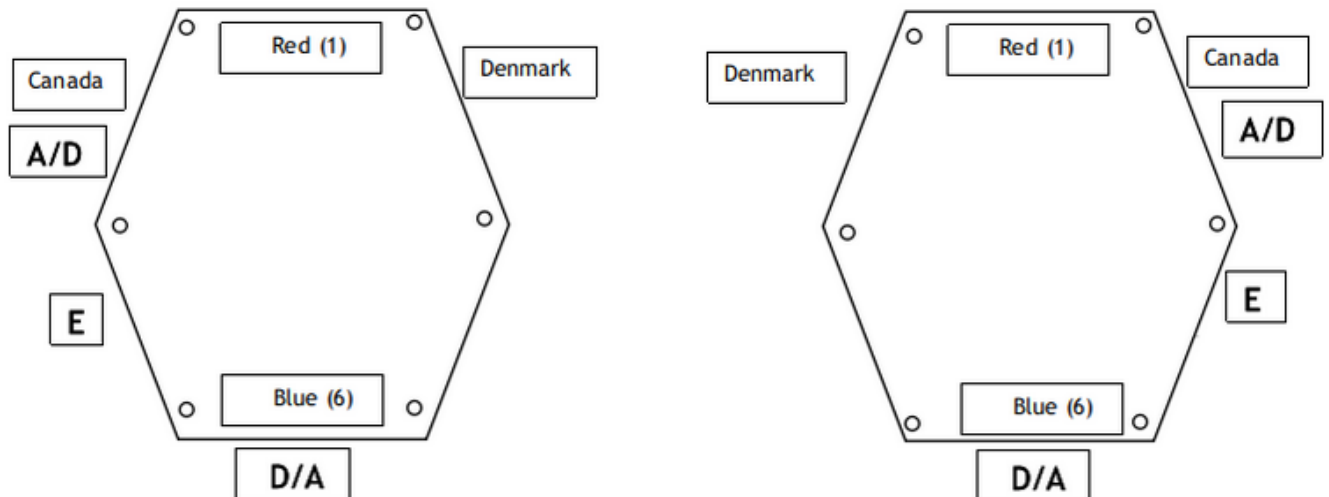


# SIVA SIVANI INSTITUTE OF MANAGEMENT

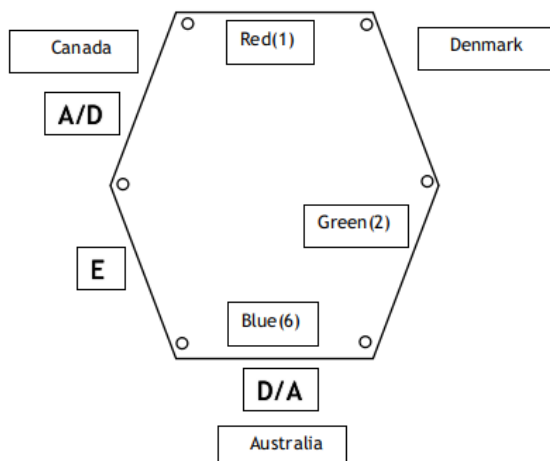
From statement 6, we can say that Rank 1 and 6 are sitting opposite each other (maximum differences in ranking, i.e. 5)



From statement 2, it is clear that the player at 6th place pocketed a blue coin as E is sitting between the player from Canada and the blue coin and from statement 8, we can infer that E cannot be ranked 1, so the arrangements possible are:

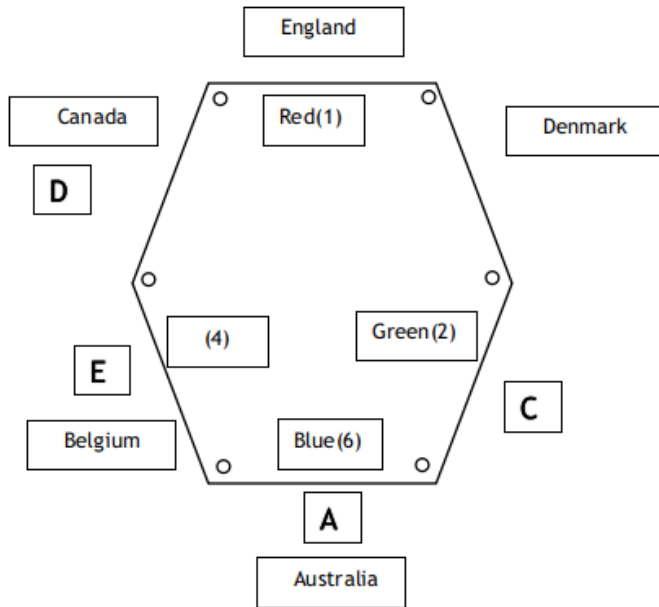


In statement 3, it is mentioned that the player ranked 3 pocketed a green coin, and from statement 7, we get the country of 6th rank player as Australia, and since Denmark player is sitting to the right of the player who pocketed the green coin, we will be able to eliminate one case, and now the case left is:

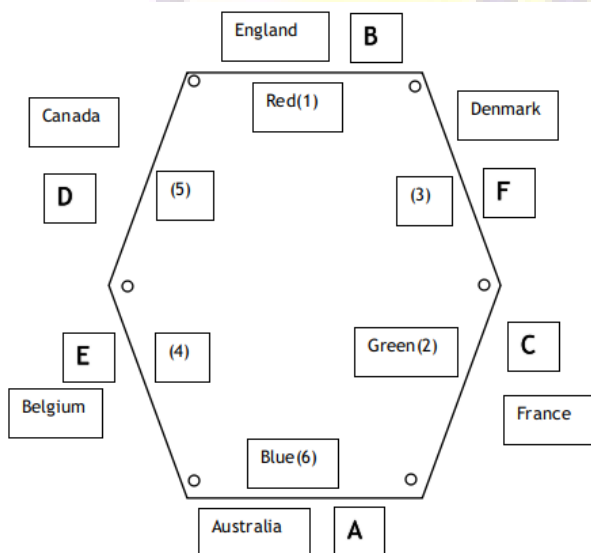


Now, let us consider two cases:

**Case 1:** A pocketed Blue coin and D will belong to Canada. Thus, C will sit to A's right, and C will be opposite D(mentioned in statement 8). Also, since only England and Belgium are remaining, E will be Belgium with rank 4 and England player rank will be 1(as mentioned in statement 4).



Statement 8 mentions the ranking order of C, F, E, i.e.  $C > F > E$ .  
 Since E is 4, F will be 3, and C will be 2.  
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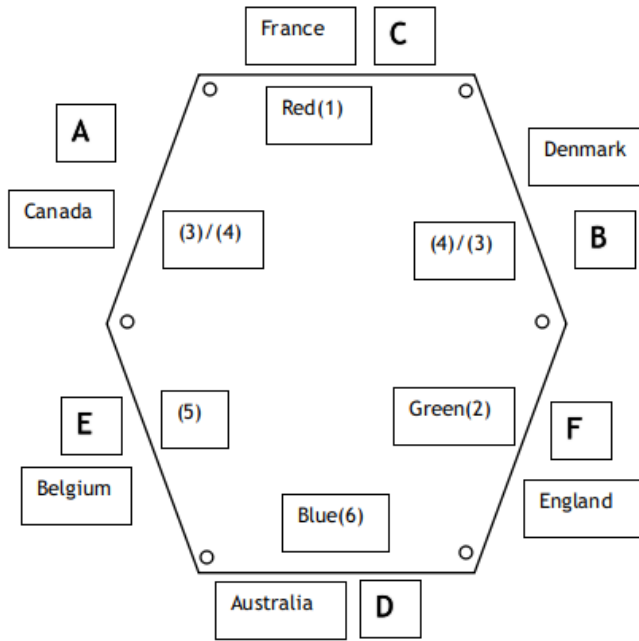


**Case 2:** D has a blue coin, and A is from Canada.

Thus C will be opposite D and will have a red coin.

The only difference of 3 between rankings is 2,5, and since F has one rank more than C, therefore, E will have 5<sup>th</sup> rank and F will have 2<sup>nd</sup>, and they will be from countries Belgium and England respectively.

Now left B will be from Denmark.



So in total, 2 seating arrangements are possible.

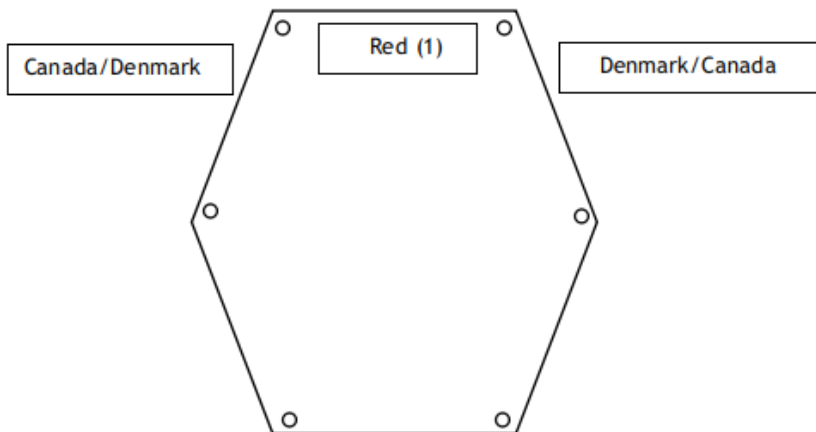
If B belongs to Denmark, case 2 will be valid, and hence F will pocket a green colour coin.

Thus, the correct option will be D.

**43. Which of the following cannot be B's rank?**

- A. 1
- B. 3
- C. 5
- D. 4

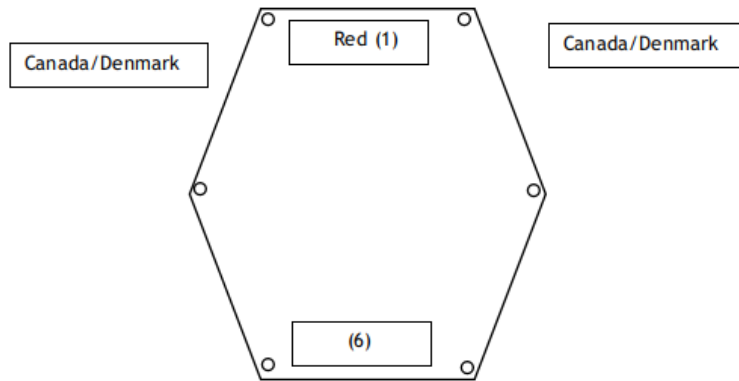
**Sol.** In statement 1, it is given that the Red coin was pocketed for the first place, and statement 4 mentions the neighbours of Rank 1 players are from Denmark and Canada in any order.



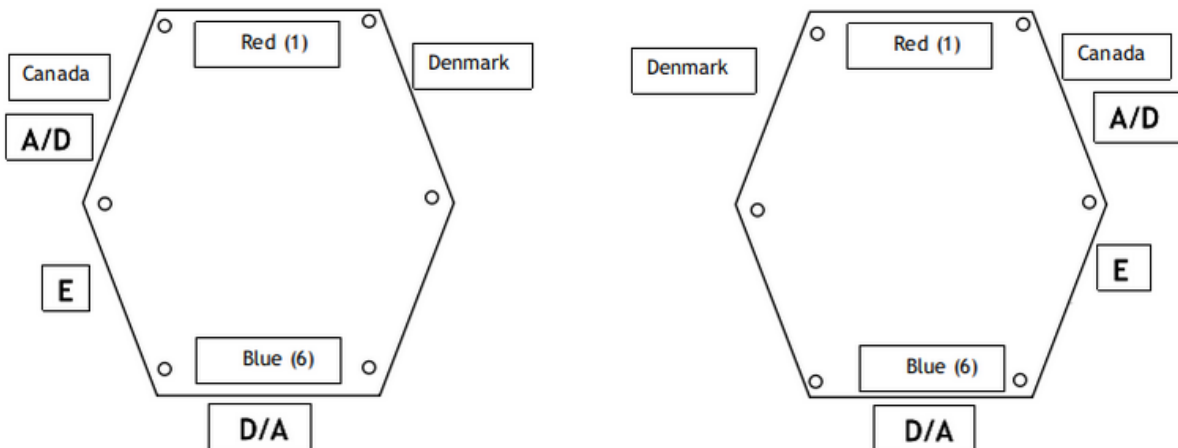


# SIVA SIVANI INSTITUTE OF MANAGEMENT

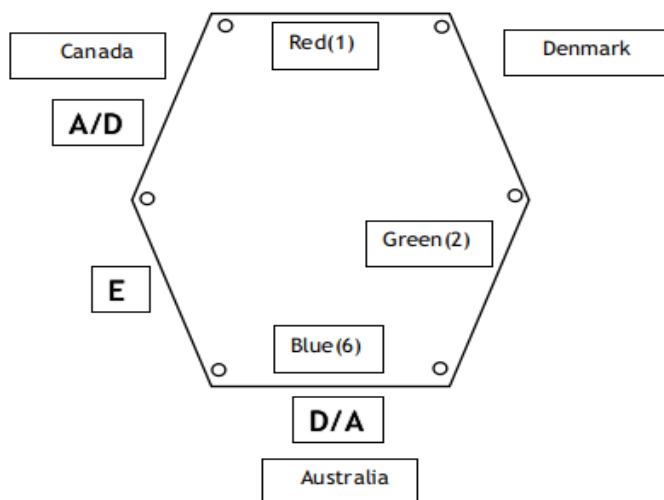
From statement 6, we can say that Rank 1 and 6 are sitting opposite each other (maximum differences in ranking, i.e. 5)



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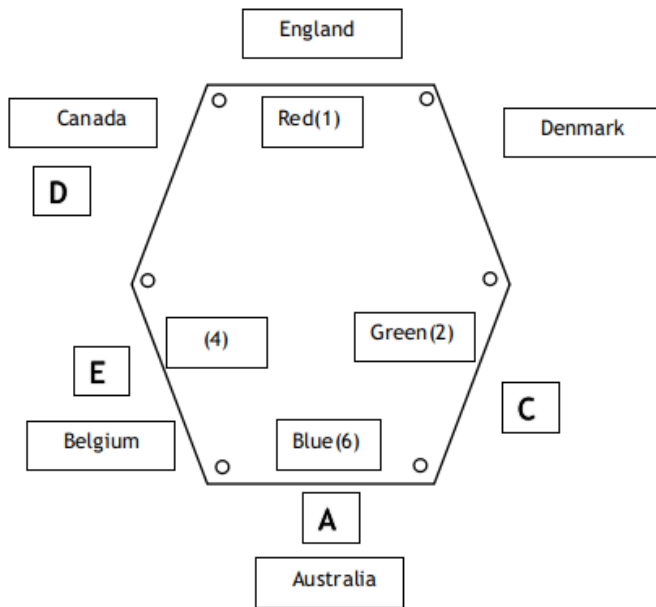
In statement 3, it is mentioned that the player ranked 3 pocketed a green coin, and from statement 7, we get the country of 6th rank player as Australia, and since Denmark player is sitting to the right of the player who pocketed the green coin, we will be able to eliminate one case, and now the case left is:



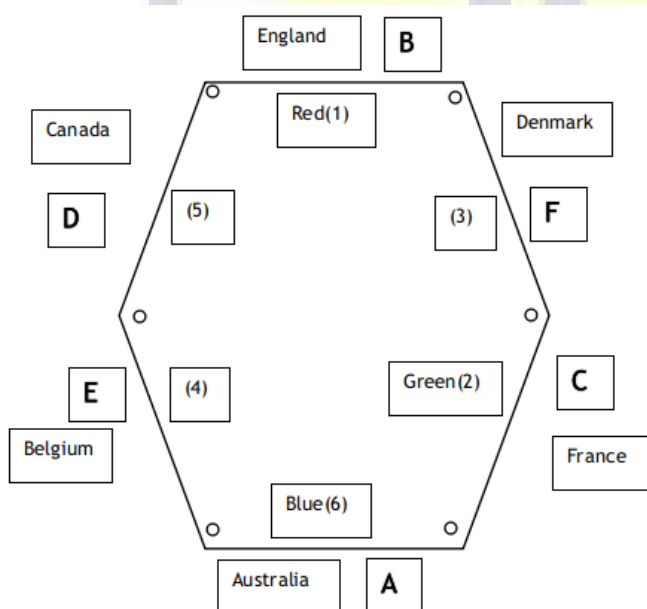


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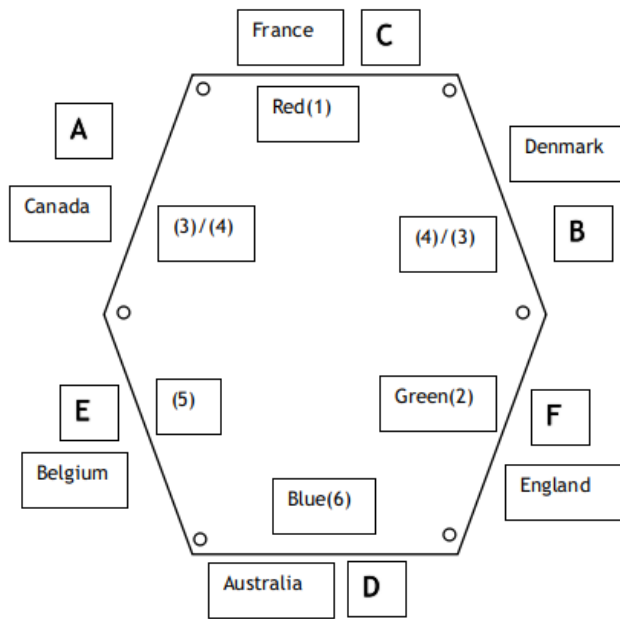


**Case 2:** D has a blue coin, and A is from Canada.

Thus C will be opposite D and will have a red coin.

The only difference of 3 between rankings is 2,5, and since F has one rank more than C, therefore, E will have 5<sup>th</sup> rank and F will have 2<sup>nd</sup>, and they will be from countries Belgium and England respectively.

Now left B will be from Denmark.



So in total, 2 seating arrangements are possible.

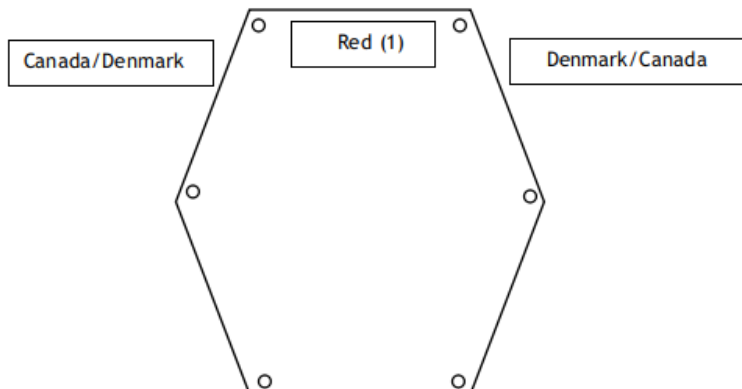
So from the above 2 cases, we found that B can score 1st,3rd and 4th rank.

Thus, B cannot have 5th rank, and hence correct option is C.

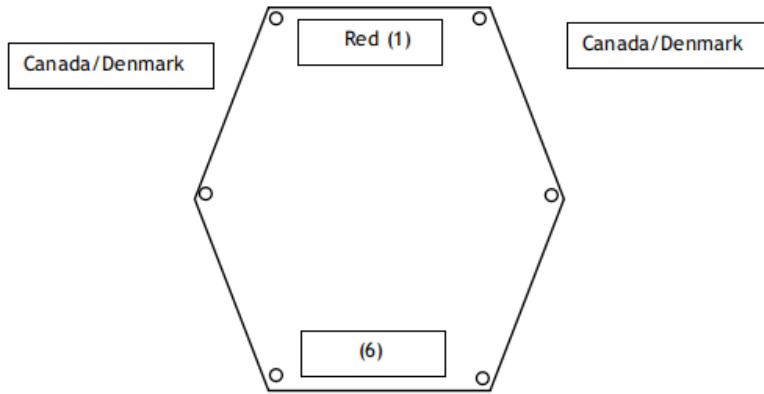
**44. In how many ways can the players sit around the Carrom board?**

- A. 1
- B. 2
- C. 4
- D. 8

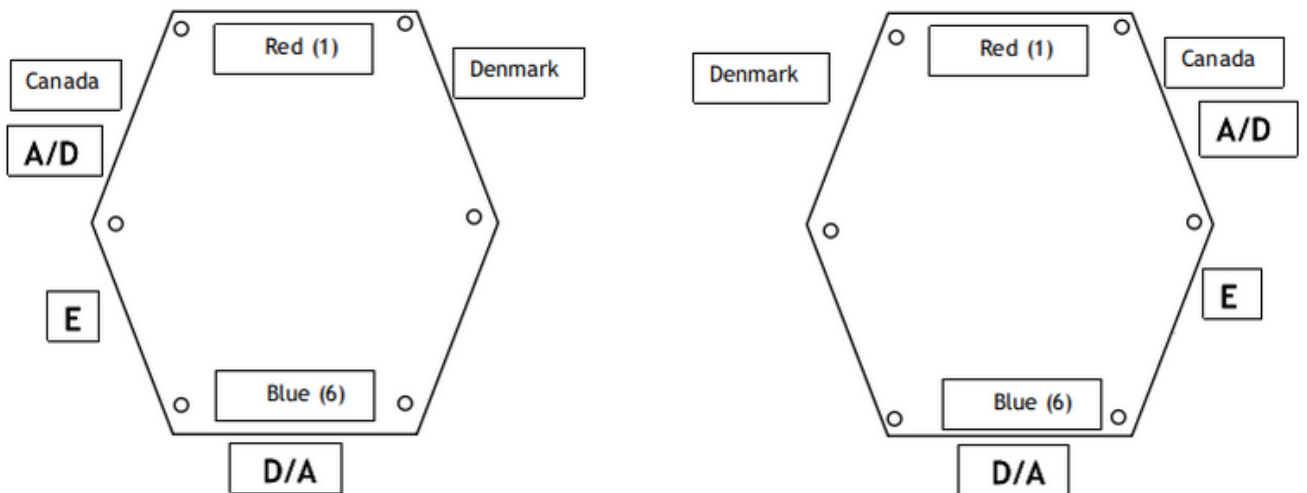
**Sol.** In statement 1, it is given that the Red coin was pocketed for the first place, and statement 4 mentions the neighbours of Rank 1 players are from Denmark and Canada in any order.



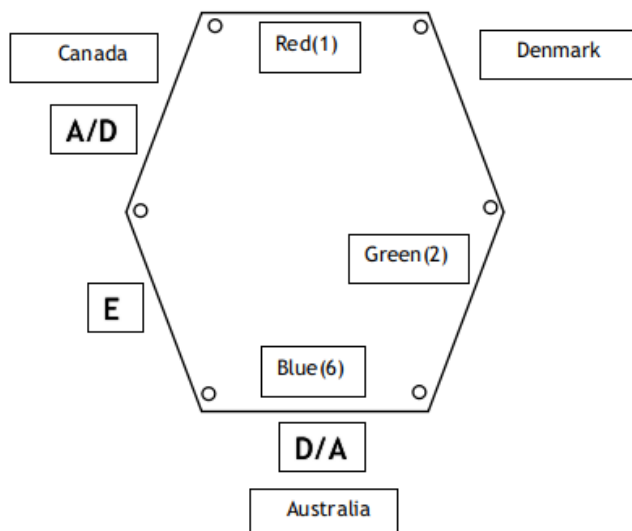
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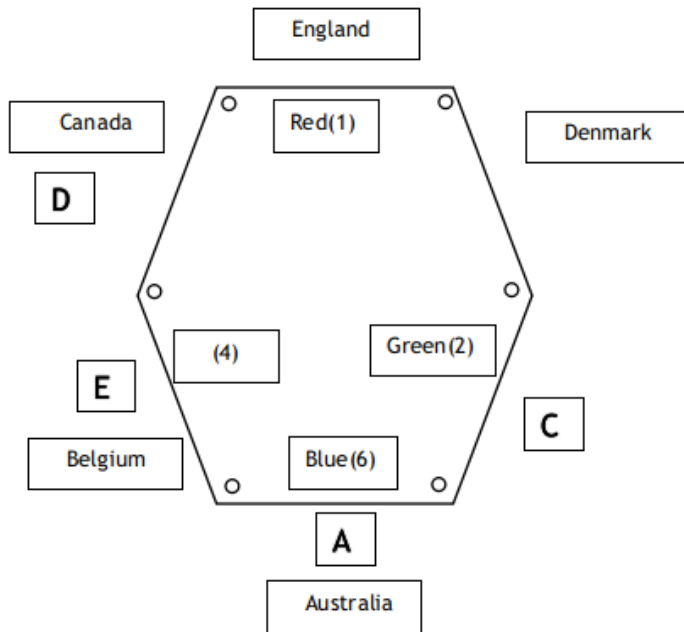


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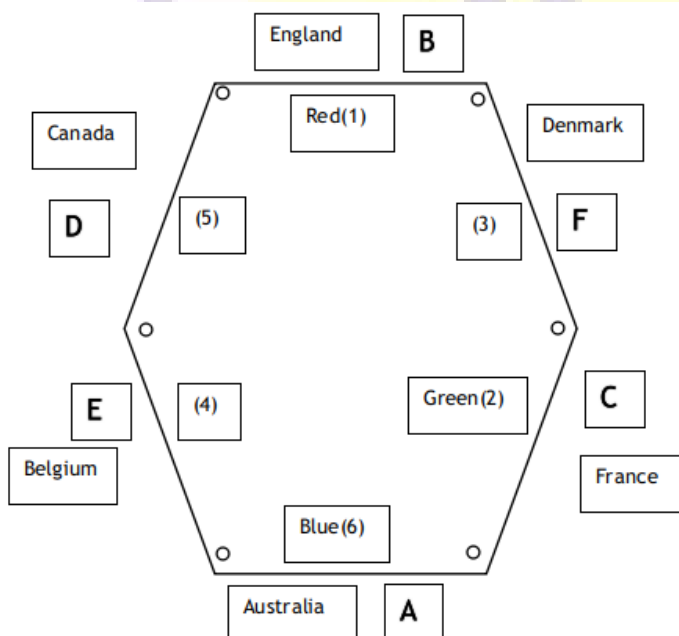


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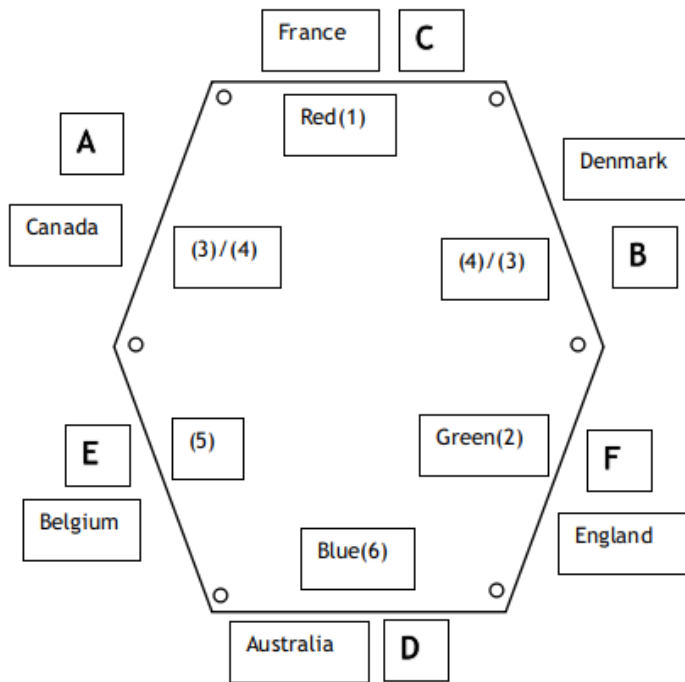


**Case 2:** D has a blue coin, and A is from Canada. Thus C will be opposite D and will have a red coin.



The only difference of 3 between rankings is 2,5, and since F has one rank more than C, therefore, E will have 5<sup>th</sup> rank and F will have 2<sup>nd</sup>, and they will be from countries Belgium and England respectively.

Now left B will be from Denmark.



So in total, 2 seating arrangements are possible, and hence the answer is b.

**45. When added to the number obtained by interchanging its digits, a two-digit number gives a number that is ten more than eight times the difference between the two numbers. If the number is less than 7070, find the number?**

**Sol.** Let the two-digit number be  $10a + b$ , where  $a$  and  $b$  are ten's and unit place digit.

Thus, the number obtained by interchanging the digits =  $10b + a$

Sum of two numbers =  $10a + b + 10b + a = 11(a + b)$

Case 1: The number obtained by interchanging the digits is higher than the original number

Thus, the difference of two numbers =  $10b + a - 10a - b = 9(b - a)$

The number obtained on summation is 10 more than 8 times the number obtained on subtraction.

$$11(a + b) = 8 \times 9(b - a) + 10$$

$$11a + 11b = 72b - 72a + 10$$

$$83a = 61b + 10$$

$$b = \frac{83a - 10}{61}$$

Now we know that the number is less than 70. Thus, the possible values of  $a$  are 1, 2, 3, 4, 5, and 6.





For  $a = 1, b = \frac{73}{61}$  --> not an integer

For  $a = 2, b = \frac{156}{83}$  ---> not an integer

for  $a = 6, b = \frac{83(6) - 10}{61} = \frac{488}{61} = 8$

Thus, the required number is 68.

Case 2: The original number to be greater than the one obtained by interchanging the digits.

We get the equation as  $b = \frac{61a + 10}{83}$

In this case, we obtain the original number as 86. Since the number is less than 70 (as mentioned in the question), this case is invalid.

Hence, the required answer is 68.

**46. Amit bought a sports bike and wanted to show off its speed to his friend Bikram. So, they decided to race on their bikes. Bikram started the race and was travelling at a speed of 60km/hr. Amit started the race half an hour after Bikram and caught up to Bikram in another half hour. If Amit was travelling at 75% of his bike's maximum speed, what is the highest speed that Amit's bike could attain?**

- A. 120 km/hr
- B. 160 km/hr
- C. 100 km/hr
- D. 90 km/hr

**Sol.** Amit started racing half an hour after Bikram. Thus, the distance between them at this point =  $60 \times \frac{1}{2} = 30\text{km}$ .

Amit caught up to Bikram in half an hour. Let Amit's speed be A km/hr.

Thus,  $\frac{30}{A-60} = \frac{1}{2}$  -->  $A = 120 \text{ km/hr}$ .

Amit was travelling at 75% of his bike's max speed. Thus, max speed that Amit's bike can attain =  $\frac{120}{0.75} = 160\text{km/hr}$ .

Hence, option B is the answer.

**47. How many integral values of x satisfy the inequality  $(\log_3x)^2 - 6\log_3x + 5 \leq 0$**

**Sol.** Let  $\log_3x = y$

Thus, the equation becomes  $y^2 - 6y + 5 \leq 0$

$y^2 - 5y - y + 5 \leq 0$

$(y - 5)(y - 1) \leq 0$



$$1 \leq y \leq 5$$

Thus,

$$1 \leq \log_3 x \leq 5$$

$$3^1 \leq x \leq 3^5$$

$$3 \leq x \leq 243$$

Thus, there are a total of 241 values of  $x$  that satisfy the given inequality.

**48. A number when divided by 7, 8 and 9 leaves remainders 1, 2 and 3, respectively. What is the difference between the remainders when the number is divided by 24 and 21, respectively?**

- A. 7
- B. 3
- C. 15
- D. 6

**Sol.** The number leaves remainders 1, 2 and 3 when divided by 7, 8 and 9, respectively. Since the difference between the divisor and the remainder is constant ( $7 - 1 = 8 - 2 = 9 - 3$ ), the required number is given by

$$\text{LCM}(7,8,9) \times n - \text{LCM}(1,2,3) = 504n - 6$$

We have to find the remainders when the number is divided by 24 and 21.

We can observe that 504 is a multiple of both 24 and 21. Thus, both will completely divide the  $504n$  part of the number.

Thus, the remainder when the given number is divided by 24 =  $(-6) = 24 - 6 = 18$ .

Similarly, on division by 21, we get the remainder as  $(-6) = 21 - 6 = 15$

Thus, the required difference between the remainders =  $18 - 15 = 3$

Hence, the correct answer is option B.

**49. Andy has participated in a cycling marathon of 6.28km long. His bicycle wheels have a diameter of 100cm and make 1000 revolutions/hour. How long will it take Andy to finish the marathon? (take  $\pi = 3.14$ )**

- A. 2 hours 50 minutes
- B. 2 hours 10 minutes
- C. 3 hours
- D. 2 hours

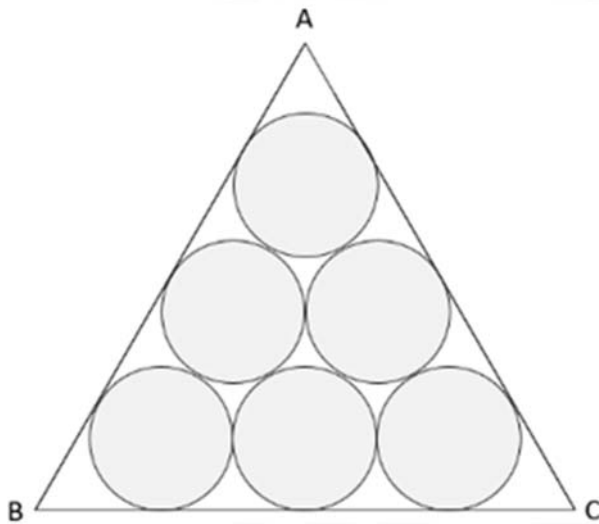
**Sol.** The circumference of each tyre of Andy's bike =  $\pi d = 3.14 * 100 = 314\text{cm}$ .

The wheels make 1000 revolutions/hour. Thus, the distance covered by Andy in an hour =  $314 * 1000 = 314000\text{cm} = 3.14\text{km}$

Thus, the time required to finish the marathon =  $6.28/3.14 = 2$  hours.

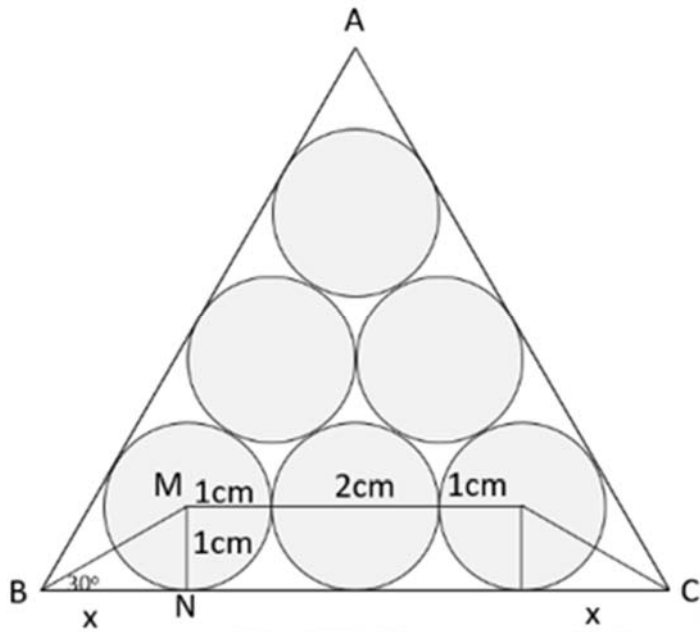
Hence, option D is the answer.

50. Circles with radii 1cm are stacked as shown in the figure, and their common tangents are connected to form a triangle. What is the inradius of the given triangle?



- A.  $1 + \frac{2}{\sqrt{3}}$
- B.  $2 + \frac{4}{\sqrt{3}}$
- C.  $\frac{5}{2}$
- D.  $2\sqrt{3}$

**Sol.** The triangle ABC is equilateral. The length of its side can be calculated by finding the value of 'xx' given in the below diagram.



$$AB = BC = AC = x + 1 + 2 + 1 + x = 2x + 4$$

In triangle MNB, angle MNB = 90° and angle MBN =  $\frac{1}{2} \times 60 = 30^\circ$

$$\text{Thus, } \tan(30) = \frac{MN}{BN} .$$

$$\frac{1}{\sqrt{3}} = \frac{1}{x}$$

$$x = \sqrt{3}$$

Thus, the side of triangle ABC =  $2\sqrt{3} + 4$

$$\text{Now, inradius} = r = \frac{\text{Area}}{\text{Semi-perimeter}}$$

$$r = \frac{\frac{\sqrt{3}}{4} \times (2\sqrt{3} + 4)^2}{\frac{1}{2} \times 3 \times (2\sqrt{3} + 4)}$$

$$r = \frac{2\sqrt{3} + 4}{2\sqrt{3}}$$

$$r = 1 + \frac{2}{\sqrt{3}}$$

Hence, option A is the answer.

**51. A function is defined as  $f(x + y) = f(x) + f(y) + f(x)f(y)$ . If  $f(1) = 1$ , find the value of  $f(13)$ .**

**Sol.**  $f(1) = 1$

$$f(2) = f(1 + 1) = f(1) + f(1) + f(1)f(1) = 1 + 1 + 1 \times 1 = 3$$

$$f(4) = f(2 + 2) = 3 + 3 + 3 \times 3 = 15$$

$$f(5) = f(1 + 4) = 1 + 15 + 1 \times 15 = 31$$

$$f(8) = f(4 + 4) = 15 + 15 + 15 \times 15 = 255$$



$$f(13) = f(5 + 8) = 31 + 255 + 31 \times 255 = 8191$$

Hence, the required answer is 8191.

**52. A sells a computer to B at a profit of 20%; B sells the computer to C at a profit of 30%; C sells the computer to D at a loss of 20%, and finally, A buys the computer from D at a price at which he had initially bought the computer at. What percentage of profit/loss did D incur?**

- A. 19.87%, profit
- B. 24.8%, loss
- C. 19.87%, loss
- D. 24.8%, profit

**Sol.** Let A bought the computer for Rs.  $100x$ . He sells the computer to B at a profit of 20%.

Thus, B bought the computer for  $1.2 \times 100x = 120x$ . Now, B sold the computer to C at a profit of 30%.

Thus, C bought the computer for  $1.3 \times 120x = 156x$ . C sold the computer to D at a loss of 20%.

Thus, D bought the computer for  $0.8 \times 156x = 124.8x$ . D sold the computer to A at  $100x$ .

$$\text{Thus, loss incurred by D} = \frac{124.8x - 100x}{124.8x} \times 100 = 19.87\%$$

Hence, option C is the answer.

**53. Amit and Richa are an athlete couple participating in the Olympics. Amit is participating in air rifle and skeet shooting events, where his probabilities of winning are  $\frac{3}{8}$  and  $\frac{1}{3}$ , respectively. Richa participates in the Long jump, 400m hurdles and 400m race, where her winning probabilities are  $\frac{1}{4}$ ,  $\frac{2}{3}$  and  $\frac{2}{3}$ , respectively. What is the probability that they both won in at least one event?**

- A.  $\frac{77}{144}$
- B.  $\frac{5}{144}$
- C.  $\frac{67}{144}$
- D.  $\frac{71}{72}$

**Sol.** The probability of both of them winning at least one event =  $P(\text{Amit winning at least one}) \times P(\text{Richa winning at least one})$

$$P(\text{Amit winning at least one event}) = 1 - P(\text{Amit losing both events}) = 1 - \left(\frac{5}{8} \times \frac{2}{3}\right) = 1 - \frac{5}{12} = \frac{7}{12}$$



$$P(\text{Richa winning at least one event}) = 1 - P(\text{Richa losing all events}) = 1 - \left(\frac{3}{4} \times \frac{1}{3}\right) = 1 - \frac{1}{12} = \frac{11}{12}$$

$$P(\text{both winning at least one event}) = \frac{7}{12} \times \frac{11}{12} = \frac{77}{144}$$

Hence, option A is the correct answer.

**54.  $M = \log_3 2 + \log_3 4 + \log_3 8 + \log_3 16 + \dots$  up to 10 terms  
and  $N = \log_2 3 + \log_2 9 + \log_2 27 + \log_2 81 + \dots$  up to 20 terms.  
What is the product of M and N?**

**Sol.**  $M = \log_3 2 + \log_3 4 + \log_3 8 + \log_3 16 + \dots$  up to 10

$$M = \log_3 2 + \log_3 2^2 + \log_3 2^3 + \log_3 2^4 + \dots + \log_3 2^{10}$$

$$M = \log_3 (2 \times 2^2 \times 2^3 \times \dots \times 2^{10})$$

$$M = \log_3 (2^{1+2+3+\dots+10})$$

$$M = \log_3 (2^{55}) = 55 \log_3 2$$

$$N = \log_2 3 + \log_2 9 + \log_2 27 + \log_2 81 + \dots$$
 up to 20 terms.

$$N = \log_2 (3 \times 3^2 \times 3^3 \times \dots \times 3^{20})$$

$$N = \log_2 (3^{1+2+3+\dots+20})$$

$$N = \log_2 (3^{210}) = 210 \log_2 3$$

$$\text{Product of M and N} = M \times N = 55 \log_3 2 \times 210 \log_2 3$$

$$= 55 \times \frac{\log(2)}{\log(3)} \times 210 \times \frac{\log(3)}{\log(2)}$$

$$= 55 \times 210$$

$$M \times N = 11550$$

**55. The sum of the roots of the quadratic equation  $ax^2 + bx + c = 0$  is equal to the sum of the squares of their reciprocals. If a,b and c real numbers, and  $a \neq 0$ , the  $bc^2, ca^2$  and  $ab^2$  are in**

- A. A.P.
- B. G.P.
- C. H.P.
- D. A.G.P.

**Sol.** Let the roots of the equation be  $x_1$  and  $x_2$ .

$$x_1 + x_2 = -\frac{b}{a} \text{ and } x_1 x_2 = -\frac{c}{a}$$

According to the question,





$$x_1 + x_2 = \left(\frac{1}{x_1}\right)^2 + \left(\frac{1}{x_2}\right)^2$$

$$x_1 + x_2 = \frac{x_2^2 + x_1^2}{(x_1 x_2)^2}$$

$$x_1 + x_2 = \frac{(x_2 + x_1)^2 - 2x_1 x_2}{(x_1 x_2)^2}$$

$$2ca^2 = ab^2 + bc^2$$

Therefore,  $bc^2$ ,  $ca^2$  and  $ab^2$  are in A.P.

**56. Six men and two boys working together can complete a piece of work in  $2\frac{1}{4}$  days. If the number of days taken by 5 boys to complete the same work is 4 more than that taken by 3 men, then the efficiency of a boy is what percent that of a man**

- A. 25
- B. 50
- C.  $33\frac{1}{3}$
- D. 40

**Sol.** Let the work done by a man and a boy in a day be  $m$  and  $b$  units respectively, and the total work be  $W$  units.

$$\text{Therefore, } 6m + 2b = \frac{W}{2\frac{1}{4}} \quad \text{-----(i)}$$

Let the number of days taken by 3 men to complete the same work be  $p$ .

$$3m = \frac{W}{p} \text{ and } 5b = \frac{W}{p+4} \quad \text{-----(ii)}$$

Substituting the value obtained from (ii) into equation (i), we get,

$$\frac{2W}{p} + \frac{2}{5} \left(\frac{W}{p+4}\right) = \frac{W}{4}$$

$$5p^2 - 7p - 90 = 0$$

On solving we get,  $p=5$  or  $-\frac{18}{5}$

Since  $p$  cannot be negative,  $p = 5$

Substituting the value of  $p$  in (ii),

$$m = \frac{W}{15} \text{ or } b = \frac{W}{45}$$

Hence, the efficiency of a boy as a percentage of a man =  $\frac{\left(\frac{W}{45}\right)}{\frac{W}{15}} = 33.33\%$



57. Two opposite vertices of a parallelogram lie at (4, 6) and (-2, 4). What is the distance between the point of intersection of the two diagonals of the parallelogram and the point (13, 0)?

- A. 13
- B. 12
- C.  $\sqrt{194}$
- D. 11

**Sol.** Diagonals of a parallelogram bisect each other. Thus, the point of intersection of the diagonals is the midpoint of the line joining the points (4, 6) and (-2, 4).

$$\text{Point of intersection} = \left( \frac{4-2}{2}, \frac{6+4}{2} \right) = (1, 5)$$

$$\text{Distance between this point and } (13, 0) = \sqrt{(13 - 1)^2 + (0 - 5)^2} = 13 \text{ units}$$

Hence, option A is the answer.

58. 150 litres of a cocktail of vodka and lime juice contains 96 litres of vodka. Initially, 30 litres of the cocktail is taken out and is replaced with water, and then 60 litres of resulting cocktail is taken out and is replaced with lime juice. The percentage of vodka in the final cocktail is

- A. 25.62%
- B. 22.56%
- C. 34.64%
- D. 30.72%

**Sol.** The important thing to understand here is that in order to determine the concentration of vodka, it does not matter that the replaced fluid is water or lime juice or any other fluid as this does not affect the concentration of vodka. What matters is the quantity of mixture replaced only.

$$\text{Initial concentration of vodka} = \frac{96}{150} = \frac{16}{25}$$

After the first operation, it becomes

$$\left( \frac{16}{25} \right) \times \left\{ \frac{(150-30)}{150} \right\} = \left( \frac{16}{5} \right) \times \left( \frac{4}{5} \right) = \frac{64}{125}$$

After the second operation, it becomes

$$\left( \frac{64}{125} \right) \times \left\{ \frac{(150-60)}{150} \right\} = \left( \frac{64}{125} \right) \times \left( \frac{3}{5} \right) = \frac{192}{625}$$

$$= 30.72\%$$

**59. A takes 35 days to complete a project alone. B takes 30 days and C takes 28 days to complete the same task alone. On the first day, A and B work on the project, B and C on the second day and A and C on the third day and the pattern repeats after this until the project is complete. On which day would the project be completed?**

- A. 8th day
- B. 12th day
- C. 10th day
- D. 16th day

**Sol.** A, B and C take 35, 30 and 28 days, respectively, to complete the project alone.

Let the project be 420 units of work.

Thus, A, B and C can complete 12, 14 and 15 units of work in 1 day.

Work done on first day =  $12 + 14 = 26$

Work done on the second day =  $14 + 15 = 29$

Work done on the third day =  $12 + 15 = 27$

Thus, in a three day cycle, total work done =  $26 + 29 + 27 = 82$

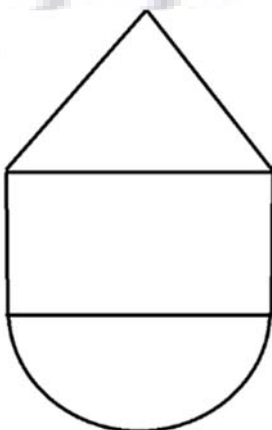
Total work =  $420 = (82 * 5) + 10$

Thus, total time required to complete the project =  $(3 * 5) + 1 = 16$  days

Therefore, the work would be completed on the 16th day.

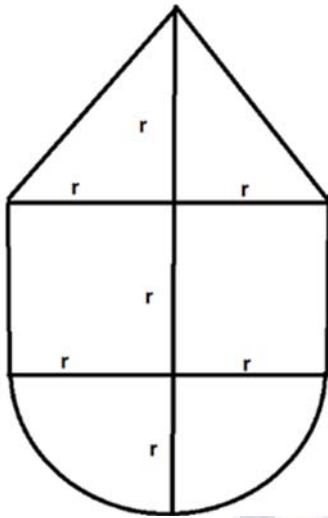
Hence, option D is the answer.

**60. As shown in the figure, an inflatable balancing toy is formed by combining three shapes: a cone at the top, a cylinder in the middle, and a hemisphere at the bottom. The radius of the hemisphere and the heights of the cylinder and cone are all equal to 40cm. If the air in this toy is used to blow up spherical balloons with a radius of 10cm, how many such balloons can be blown?**



- A. 100
- B. 96
- C. 48
- D. 128

**Sol.** To find the number of balloons that can be filled, we need to find the volume of the given figure.



Volume = volume of cone + volume of cylinder + volume of hemisphere

$$= \left(\frac{1}{3}\right)\pi R^2 h + \pi R^2 h + \left(\frac{2}{3}\right)\pi R^3$$

$$= \left(\frac{1}{3}\right)\pi r^3 + \pi r^3 + \left(\frac{2}{3}\right)\pi r^3$$

$$= 2\pi r^3$$

$$= 2\pi(40)^3$$

$$= 128000\pi \text{ cm}^3$$

$$\text{Volume of each balloon to be filled} = \left(\frac{4}{3}\right)\pi r^3 = \left(\frac{4}{3}\right)\pi(10)^3 = \frac{4000}{3}\pi$$

Let the number of balloons that can be filled be  $n$ .

$$128000\pi = n \times \left(\frac{4000}{3}\right)\pi$$

$$n = 96$$

Hence, option B is the answer.

**61.** Harry along with his friends Hermione and Ron visits the Black Lake. Harry knows that the Black Lake has some magical powers by which it triples the quantity of candies put into it. Harry takes some candies and puts them into the Black Lake. Then he divides them into  $n$  equal groups and offers one of the groups to Ron. Harry puts the remaining candies into the Black Lake again. Then, again, forms  $n$  equal groups and offers one of these groups to Hermione. The ratio of the number of candies which Ron got to the number of candies remaining after giving it to Hermione is 2:25. Find the value of  $n$ .

**Sol.** Let  $x$  be the number of candies in the beginning

When put into the Black Lake they become  $3x$ .

The number of candies remaining after giving it to Ron =  $3x \times \frac{(n-1)}{n}$



When again put into Black Lake they become  $9x \times \frac{(n-1)}{n}$

The number of candies remaining after giving it to Hermoine =  $9x \times \frac{(n-1)}{n} \times \frac{(n-1)}{n}$   
 $= 9x \times \frac{(n-1)^2}{n^2}$

According to the question

$$\frac{\left\{3x\left(\frac{1}{n}\right)\right\}}{9x \frac{(n-1)^2}{n^2}} = \frac{2}{25}$$

$$\frac{n}{3(n-1)^2} = \frac{2}{25}$$

$$25n = 6n^2 - 12n + 6$$

$$6n^2 - 37n + 6 = 0$$

$$(6n - 1)(n - 6) = 0$$

Therefore  $n = 6$  or  $1/6$  but candies cannot be a fraction number so  $1/6$  is rejected.

**62. Ajit buys a new smart tv worth Rs. 50000. He pays the initial deposit of Rs. 4500, and the remaining money is paid in three equal instalments in three years at the rate of 20%pa. What is the value of each instalment?**

**Sol.** Let the instalment amount be Rs.  $x$ .

Since the principal is being charged interest, the instalments will have to compensate for the increase in value.

$$45500 \times (1.2)^3 = x + (1.2)x + (1.2^2)x$$

$$45500 * (1.728/3.64) = x$$

$$x = 21600$$

**63. A microbiologist studied two types of bacteria - Type I and Type II - and observed that the number of Type I bacteria doubled every four minutes, whereas the number of Type II bacteria tripled every five minutes. If at the end of 20 minutes there were a total of 2000 bacteria, then what was the difference between the number of bacteria of two types initially?**

- A. 4
- B. 6
- C. 8
- D. 9

**Sol.** Let the initial number of type-I and type-II bacteria be denoted by  $a$  and  $b$  respectively.

As type-I bacteria doubled every 4 minutes, so at the end of 20 minutes we would get  $2^5a = 32a$   
the number of type-II bacteria at the end of 20 minutes will be  $3^4b = 81b$

It is given that,

$$32a + 81b = 2000$$

$$81b = 2000 - 32a$$

$$81b = 16(125 - 2a)$$

Therefore  $81b$  should be a multiple of 16, which implies that  $b$  is a multiple of 16.

Therefore the minimum possible value of  $b$  is 16.

$$\text{Hence, } 32a + 81(16) = 2000$$

$$32a = 704$$

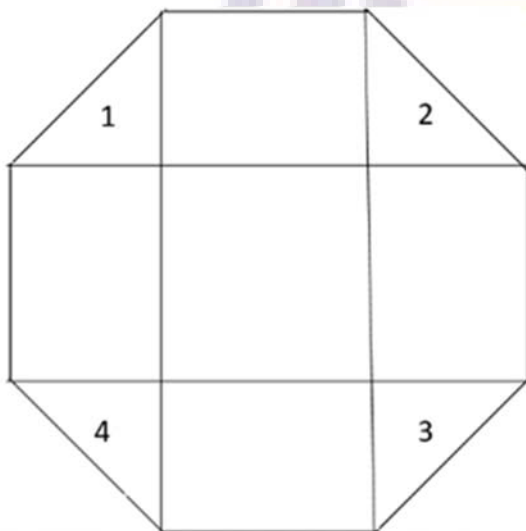
$$\text{Therefore } a = 22$$

The next multiple of 16 is 32, but  $81 \times 32$  gives 2592 which is more than 2000.

$$\text{So, } a = 22 \text{ and } b = 16$$

Thus, initial difference between the number of bacteria of the two types taken is 6.

**64. From a metal sheet in the shape of a regular octagon with a side length of 4cm, triangular portions (1, 2, 3 and 4) are cut from the corners and the sides folded in order to make a hollow cuboid. What is the volume of the cuboid formed?**



A.  $16\sqrt{2}$  cubic cm

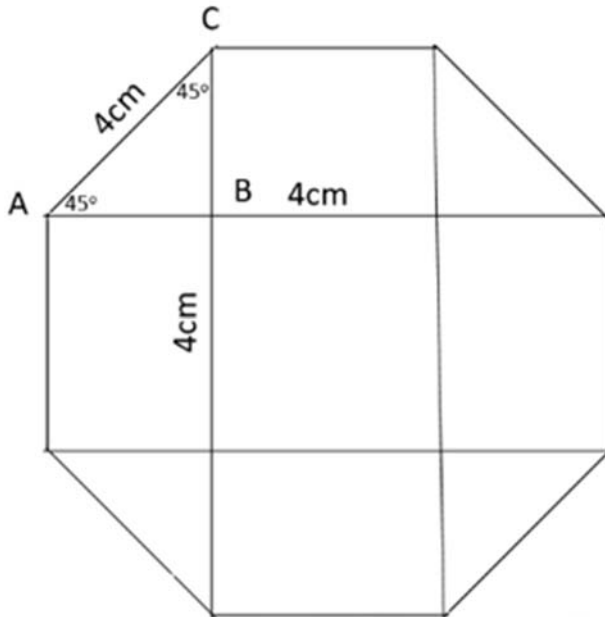
B.  $4\sqrt{2}$  cubic cm

C. 32 cubic cm

D.  $32\sqrt{2}$  cubic cm

**Sol.** After the sides are folded to form a cuboid, the base will be a square with sides equal to the sides of the octagon, and the height of the cuboid will be given by the side BC or AB, as shown in the figure below.





Let  $l$ ,  $b$  and  $h$  be the length, breadth and height of the required cuboid, respectively. Thus,  $l = 4$  cm and  $b = 4$  cm.

Interior angle of a regular octagon =  $135^\circ$

Thus, in triangle ABC, angle CAB = angle ACB =  $45^\circ$

Triangle ABC is a 45-45-90 triangle with  $AB = BC = h$

Using Pythagoras theorem,  $AC^2 = AB^2 + BC^2$

$$4^2 = h^2 + h^2$$

$$2h^2 = 16$$

$$h = 2\sqrt{2}$$

Thus, the volume of the required cuboid =  $l \times b \times h = 4 \times 4 \times 2\sqrt{2} = 32\sqrt{2}$

Hence, option D is the answer.

**65. A grocery store owner cheats his supplier and customers by 25%, using a faulty weight, while buying and selling rice, i.e., receives 25% more during buying and gives 25% less while selling. What is the overall profit that he makes?**

- A. 33.33%
- B. 50%
- C. 66.66%
- D. 40%

**Sol.** Let the selling price of the supplier be Rs. 100 per 1000gm.

Thus, while buying from the supplier the store owner gets 1250gm for Rs. 100.

While selling to his customers, he sells 750gm for Rs. 100.



Thus, for 1250gm, he will get  $\frac{1250 \times 100}{750} = \text{Rs. } 166.66$

Thus, the overall profit of the store owner =  $\frac{(166.66-100) \times 100}{100} = 66.66\%$

Hence, option C is the answer.

**66. Solutions A, B and C are made up of fluids P, Q, R, and S. The ratio of P, Q, R and S in A is 1:2:3:4, and B is 2:4:6:8, and in C is 1:1:1:1. If 20litres of A, 10litres of B and 8litres of C are mixed, how much (in litres) pure P, Q, R and S should be added to the resulting mixture so that the final proportions of P, Q, R and S is 1:1:1:1?**

- A. (9, 6, 3, 1)
- B. (3, 6, 9, 0)
- C. (9, 6, 3, 0)
- D. (1, 3, 6, 9)

**Sol.** 20litres of A, 10litres of B and 8litres of C have P, Q, R and S in volumes as given in the below table.

XXXX	P	Q	R	S	Total
A	2	4	6	8	20
B	1	2	3	4	10
C	2	2	2	2	8
Total	5	8	11	14	38

Thus, to make the final proportion as 1:1:1:1, we will have to add 9litres of P, 6litres of Q and 3litres of R.

Hence, option C is the correct answer.