



**PGDBA 2017**

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## Instructions

In each of the questions a word has been used in sentences in four different ways. Choose the option corresponding to the sentence in which the usage of the word is incorrect or inappropriate

### Question 1

#### Match

- A "This marriage is a match made in heaven" she gushed.
- B "Please light the match so that I can see the switch" said my friend
- C It was an even match between the two contestants
- D This movie sequel is not a match on the original.

**Answer:** D

#### Explanation:

In sentence A, the word match means betrothal or engagement and the usage is correct.

In sentence B, the word match is the noun which is the object used to light a fire.

In sentence C, the word match means rivals and the usage is correct yet again.

However, in sentence D, the word match though implies equal in quality, the usage is incorrect, and the correct usage would be "This movie sequel is no match to the original."

Therefore the correct option is D.

### Question 2

#### Accede

- A She was confident that her manager would accede to her earnest request.
- B It would have been difficult for the teacher to accede to their latest proposal.
- C The ballerina could not accede to the demands of her hectic tour schedule.
- D The princess could not accede to the throne vacated by her late father.

**Answer:** C

#### Explanation:

The word "accede" can be used in two contexts, the first being one where it means to agree to a demand or a request and the second instance where it means to assume office or position.

In option A, the word correctly used as the manager can accede to a request.

In option B, again the usage is correct as it can be difficult to accede to a proposal.

In option D, the usage is appropriate as assuming the throne can be rephrased as acceding to the throne.

But in option C, the usage is incorrect as here the word "demands" means requirements or needs and the correct usage would be "meet" or "fulfil".

So the correct choice is C.

## Instructions

For the following questions answer them individually

### Question 3

Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (a, b, c, d) choose the most appropriate option.

- (i) It would secure a 25% increase in overall revenue; and devoted but cash-strapped supporters would have more opportunities to watch their team.
- (ii) The Football Supporters Federation maintains that, under government regulations about spectator density, safe-standing sections would allow 1.8 people to occupy the same space as one seated match-goer.
- (iii) The willingness of the Premier League to consider reintroducing terraces has less to do with reminiscing, however, than with pragmatism.
- (iv) If the Football Supporters Federation's is correct, then both clubs and fans would stand to gain since the teams could offer a reduction on the price of standing tickets.

- A (ii), (iii), (iv), (i)
- B (iv), (ii), (i), (iii)
- C (iii), (ii), (iv), (i)
- D (iv), (ii), (iii), (i)

Answer: C

#### Explanation:

Sentence (iii) is an opening statement about the idea of Premier League to reintroduce terraces. Sentence (ii) is the statement of the Football Supporters Federation in favour of (iii). Sentence (iv) states that if (iii) is correct, then it would benefit both clubs and the fans. Sentence (i) elaborates how (iv) will help each party.

Therefore the right order is (iii)(ii)(iv)(i).

### Question 4

Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (a, b, c, d) choose the most appropriate option.

- (i) In an integrated market one country might specialise in a high-wage industry with increasing returns to scale and others in areas in which wages are lower.
- (ii) New models of trade do not imply that close economic integration should cause incomes to converge.
- (iii) As freer trade expands the size of the market, producers with initial size advantages outcompete rivals.
- (iv) Firms and places are often subject to economies of scale: they become more productive as they grow larger.

- A (ii), (iv), (iii), (i)
- B (iv), (ii), (i), (iii)
- C (ii), (iv), (i), (iii)
- D (iv), (ii), (iii), (i)

Answer: C

#### Explanation:

(ii) puts forward a statement about new models of trade and how they do not imply that close economic integration should cause incomes to converge. (iv) gives an example for (ii). (i) talks about the implications of an integrated market whereas (iii) provide the effects of free trade.

Therefore the correct order is (ii)(iv)(i)(iii).

### Question 5

Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (a, b, c, d) choose the most appropriate option.

- (i) Taken together, these elements enable developers to discover and build on what works, to jettison what does not work, and, when necessary, to "fail fast"—before they have expended significant resources or large amounts of time on a project.
- (ii) Over the past few decades, the business world has seen the emergence of several process and product improvement platforms.
- (iii) Both of those platforms emphasize experimentation and rapid iteration, strong feedback loops that facilitate early and continuous engagement with end users, and the use of minimally designed prototypes to test products or processes.
- (iv) Examples include human-centred design, a product innovation method developed by the design firm IDEO, and lean experimentation, an entrepreneurship method that originated in Silicon Valley.

- A (i), (ii), (iii), (iv)
- B (ii), (iv), (iii), (i)
- C (i), (iv), (ii), (iii)
- D (ii), (i), (iii), (iv)

**Answer: B**

#### Explanation:

(ii) puts forward a statement about the emergence of new concepts in business in the last many years. (iv) gives two examples of the innovations mentioned in (ii). (iii) presents the similarities between the two cases discussed earlier, whereas (i) tells us the applications both these innovations have when taken together.

Hence the correct order is (ii)(iv)(iii)(i).

#### Instructions

Read the passage and answer the questions that follow:

Passage I

There are two main kinds of development agency: the one which trace to introduce specific changes and is mainly interested in material development: and the other which is primarily interested in people. On the whole the first wants to "get things done"; the other to develop the people's own abilities for leadership, wise judgement and co-operative action. For agencies of the second kind, the material result is less important than the way it is achieved.

Agencies and workers, who themselves decide the specific form development should take, assume, of course, that they know better than the people what the people need. Most social development workers and technical officers have worked on this assumption in the past, and although they were often right they were not always right, for they sometimes made the mistake of assuming that what was good within their own culture was certain to be good in other cultures too. Missionaries, for instance, insisted on their converts wearing clothes because they were used to them themselves, and they established schools with syllabuses that suited the missionaries' own countries, rather than the countries where the schools were built.

Agencies and their workers tend to be more careful nowadays, but experts and specialists trained in Western ways still often make mistakes in cultures other than their own. Agencies everywhere are now realizing that they are risking failure if they assume that their own ideas are right in environments and cultures other than their own. The East African Groundnut Scheme failed because it did not take the local conditions of soil and climate sufficiently into account. The West African Anchau Rural Development Scheme illustrates, less spectacularly, the result of failing to consider the human factor when working in a different culture.

This Scheme was started in 1937 to eradicate sleeping sickness from a part of the Zaria province of the Northern Region of Nigeria. The people in charge made a detailed survey of the area, made detailed studies of the farming conditions in sample hamlets and made a careful census of the people. Indeed, they scientifically examined in minute detail every aspect of the situation that seemed to them important. But it failed because people were thought of as being there "to be done good to" in the mass, but they were not envisaged as persons, each with one's own small world of hopes and fears, who might in some way be consulted.

### Question 6

In the passage "development agency" refers to

- A the agenda for development
- B the freedom of people to participate
- C social workers engaged in development activities

D aid organizations engaged in development work

**Answer: A**

**Explanation:**

In the passage, the word "agency" does not refer to a business or organization providing a particular service or a group of people working for such a firm. Here it means a plan of action for producing results or in other words, an agenda for development. Therefore the answer we are looking for is A.

**Question 7**

**According to the author, development agencies who want to "get things done" are**

- A Interested in economic outcomes and progress for the area
- B concerned with initiating specific changes to improve natural conditions in an area
- C focused on quantifiable benefits to local communities
- D reliant on external experts and consultants for solutions to community issues

**Answer: A**

**Explanation:**

The author mentions that the development agencies who want to "get things done" are mainly interested in material development. Hence, such agencies are interested in the economic outcomes and progress of the area.

Therefore the correct option is A.

**Question 8**

**The West African Anchau Rural Development Scheme failed because**

- A local conditions were different from those in Western cultures
- B the men heading the project went into too much of detail and forgot the big picture
- C the project coordinators did not consult or involve local people in the change initiative
- D the development experts thought they knew better than the locals, what was required

**Answer: C**

**Explanation:**

The author says that the West African Anchau Rural Development Scheme failed as a result of failing to consider the human factor when working in a different culture. By this, he means that the coordinators of the project did not involve the local people in the initiative.

Therefore the answer is C.

**Question 9**

**In this passage the main point that the author wants to make is that**

- A there are two approaches to bringing about change in a community
- B western experts are successful in their own cultures but make mistakes in other cultures
- C one cannot have a universal approach to development, it has to be nuanced
- D involvement and participation of local communities is essential for implementing change

**Answer: C**

**Explanation:**

In the passage, the author is trying to make the point that the idea of

development varies in different cultures. What may be development for one society may be detrimental in another community. The option that best conveys this idea is option C.

### Instructions

Read the passage and answer the questions that follow:  
Passage II

Humans are pretty inventive creatures. That might be cause for optimism about the future of global change. We've found solutions to lots of problems in the past. And with a much larger and better-educated population than the world has ever seen — the supply of good ideas can only increase. So innovation will figure out a way to sustainable futures.

But what is innovation? The media and companies routinely equate innovation with shiny new gadgets. In the same spirit, politicians charged with managing economies frequently talk as if all innovation is good. The history of almost any technology, however — from farming to applied nuclear physics — reveals a mixture of good and bad.

The study of the concept of innovation, and of whether it can be steered, is a relatively recent academic effort. There are three ways that scholars have thought about innovation. The first was basically linear: science begets invention that begets innovation. Physics, for instance, gives us lasers, which give us — eventually — compact discs. Result: Growth! Prosperity! Rising living standards for all! From this perspective, it's assumed that science is the basis for long-term growth, and that innovation largely involves commercialisation of scientific discoveries. There is a role for the state, but only in funding the research. The rest can be left to the private sector.

By the 1970s, economists interested in technology and some policy-makers were talking about something more complicated: national systems of innovation competing with each other. Such "systems" included measures to promote transfer of technology out of the lab, especially by building links between centres of discovery and technologists and entrepreneurs.

The key failing of these two approaches is that they treat less desirable outcomes of innovation as externalities and are blind to the possibility that they may call for radically different technological priorities. The environmental effects of energy and materials-intensive industries may turn, out to be more destructive than we can handle.

Radical system change is a third way to think about innovation. Technological trajectories aren't pre-ordained: Some paths are chosen at the expense of others. And that's harder because it needs more than incremental change. The near future is about transformation. The more complex historical and social understanding of innovation now emerging leads to a richer concept of infrastructure, as part of a system with social and technical elements interwoven.

An emphasis on the new, the experimental, the innovative - and on promoting social and technical solutions to global problems must overcome the sheer inertia of the systems we have already built - and are often still extending. Aiming for transformation leads to another take on creative destruction. It isn't enough to promote innovation as creation, the existing system has to be destabilized as well. System shifts of the radical kind envisaged will call for creation of a new infrastructure. But that won't do the job unless the old systems are deliberately removed on roughly the same time-scale. Achieving that will call for a lot more thought about how to if not destroy the old systems, at least set about dismantling them.

### Question 10

From the passage we can conclude that the author believes

- A science is the only basis for long term growth
- B innovation should focus only on transformation
- C creative destruction is one way of describing innovation
- D science begets invention that begets innovation

Answer: C

### Explanation:

In the passage, the author focuses on innovation, and innovation cannot be equated to science. He also mentions that we should also consider the less desirable outcomes of innovation.

The idea that "science begets invention that begets innovation" is not that of the author, but instead, it was used by scholars who thought about innovation.

The idea of the author is made clear in the last paragraph. He is of the opinion that innovation can be made plausible only by dismantling, if not completely destroying, the existing systems. So creative destruction is one way of describing innovation. Therefore the correct option is C.

**Question 11**

**According to the author, the first two approaches related to the study of innovation are inadequate because**

- A they treat the negative fallouts as unintended outcomes to be managed separately
- B innovation is neither linear nor confined to national systems of innovation
- C the priorities of innovation in the first two approaches are inappropriate
- D all of the above

**Answer: A**

**Explanation:**

In the passage, the author clearly mentions that "The key failing of these two approaches is that they treat less desirable outcomes of innovation as externalizes".

Hence the correct option is A.

**Question 12**

**The key difference between the first and second approaches related to the study of innovation is**

- A in placing science as the basis for inventions and innovation
- B in how they treat the less desirable outcomes of innovations
- C in assuming that all innovation is good
- D in placing a greater emphasis on the role of government and policy in innovation

**Answer: D**

**Explanation:**

In the first approach, the government plays a minimal role by just funding the research. On the other hand, the second approach presents the idea of national systems of innovation which compete against one another. So the difference between the two approaches is the varying emphasis on the role of government and policy in innovation.

Hence the correct option is D.

**Question 13**

**Which of the following statements best describe the author's view on innovation?**

- A Innovation will figure out a way to sustainable futures
- B Given the destructive potential of incremental innovation we need radical change
- C Innovation largely involves commercialization of scientific discoveries
- D For innovation to work, the existing system has to be destabilized

**Answer: A**

**Explanation:**

The ideas mentioned in other options, though mentioned in the passage, they are either the ideas of others that are mentioned or are not in sync with the idea of the author. The statement that most resonates with the idea of the author himself is that innovation will figure out a way to sustainable futures.

**Question 14**

**By the expression, "The media and companies routinely equate, innovation with Shiny new gadgets", the author is**

- A making an assertion about media and companies

- B questioning the wisdom of media and companies
- C trying to explain why politicians frequently talk as if all innovation is god
- D denigrating the commercial approach of media and companies

**Answer: D**

**Explanation:**

When the author says "The media and companies routinely equate innovation with shiny new gadgets", he is unfairly critical of the media-commercial approach of media and companies.

So the correct option is D.

**Question 15**

**According to the author, radical systems change is primarily about**

- A reducing the negative environmental effects of energy and materials-intensive industries
- B a more complex historical and social understanding of innovation
- C transformation concomitant with the creation of a new infrastructure
- D experimenting to promote social and technical solutions to global problems

**Answer: C**

**Explanation:**

The author describes how radical systems change a way to think about innovation, and it is associated with the creation of new infrastructure.

The other options are not in line with the author's idea.

Hence the correct option is C.

## Reasoning

**Instructions**

Answer the questions based on the following information.

Examinations were held during the two weeks of January – Sunday the 3rd to Saturday the 16th. There was one examination each for the six subjects namely, Sociology, Psychology, Economics, Political Science, Anthropology and Biology. There was no more than one examination on any day. No examinations were held on Saturdays, Sundays and on January 5th, which was a national holiday. Exactly three examinations were held in each week. The Psychology examination was held before the Economics examination, and the Political Science examination was held the day after the Biology examination. The Economics and the Political Science examinations were held on the same day of the week. Similarly, the Sociology and the Psychology examinations were held on the same day of the week. There were no examinations for three days between the Sociology examination and the examination prior to it. The Biology and the Anthropology examinations were held on a Tuesday and a Thursday respectively.

**Question 16**

**On which of the following set of dates were there no examinations?**

- A 11<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> January
- B 8<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> January
- C 7<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> January
- D 7<sup>th</sup>, 8<sup>th</sup> and 15<sup>th</sup> January

**Answer: E**

**Question 17**

On which of the following dates was the Biology examination held?

- A 5<sup>th</sup> January
- B 6<sup>th</sup> January
- C 12<sup>th</sup> January
- D 13<sup>th</sup> January

**Answer: E**

**Question 18**

Which examination was held on 4<sup>th</sup> January?

- A Sociology
- B Psychology
- C Political Science
- D Biology

**Answer: E**

**Question 19**

The number of days (including weekends and holidays, if any) between the Psychology and the Anthropology examination is

- A One
- B Two
- C Three
- D Four

**Answer: E**

**Question 20**

Which examinations were held in the first week?

- A Economics, Psychology and Anthropology
- B Economics, Political Science and Psychology
- C Economics, Political Science and Sociology
- D Economics, Political Science and Anthropology

**Answer: E**

**Instructions**

Answer the questions based on the following information.

The following table gives the urban population of a country and the percentages of total population in rural and urban areas as recorded in the 10-years censuses during 1901-81.

**Table 1.** Urban and rural population 1901-1981

Year	Urban population (in million)	Percentage of Total Population	
		Rural	Urban
1901	25	90	10
1911	26	90	10
1921	28	89	11
1931	33	88	12
1941	44	86	14
1951	62	82	18
1961	79	82	18
1971	100	80	20
1981	150	75	25

**Question 21**

The percentage increase in total population of the country between 1901 and 1981 is

- A 500%
- B 150%
- C 140%
- D cannot be determined

**Answer: C**

**Explanation:**

Year	Rural population	% of Rural population	Urban population	% of Urban population
1901	225	90	25	10
1911	234	90	26	10
1921	226.54	89	28	11
1931	242	88	33	12
1941	270.29	86	44	14
1951	282.44	82	62	18
1961	359.89	82	79	18
1971	400	80	100	20
1981	450	75	150	25

From the table ,

$$\begin{aligned} \text{Total population in 1901} &= \text{Rural population in 1901} + \text{Urban population in 1901} \\ &= 225 + 25 = 250 \end{aligned}$$

$$\begin{aligned} \text{Total population in 1981} &= \text{Rural population in 1981} + \text{Urban population in 1981} \\ &= 450 + 150 = 600 \end{aligned}$$

$$\begin{aligned} \text{Percentage increase in population from 1901 to 1981 is} &= \frac{600 - 250}{250} * 100 \\ &= 350/250 * 100 \end{aligned}$$

=140%

Hence C is the correct answer.

**Question 22**

The percentage increase in density of population in the urban areas between 1951 and 1981 is

- A about 60%
- B about 250%
- C above 500%
- D cannot be determined

**Answer: D**

**Explanation:**

Year	Rural population	% of Rural population	Urban population	% of Urban population
1901	225	90	25	10
1911	234	90	26	10
1921	226.54	89	28	11
1931	242	88	33	12
1941	270.29	86	44	14
1951	282.44	82	62	18
1961	359.89	82	79	18
1971	400	80	100	20
1981	450	75	150	25

Since area is not known density of urban areas cannot be determined.

Hence D is the correct answer.

**Question 23**

The largest rate of increase in urban population in a decade during 1901-1981 occurred in

- A 1971-81
- B 1961-71
- C 1951-61
- D 1941-51

**Answer: A**

**Explanation:**

Year	Rural population	% of Rural population	Urban population	% of Urban population
1901	225	90	25	10
1911	234	90	26	10
1921	226.54	89	28	11
1931	242	88	33	12
1941	270.29	86	44	14
1951	282.44	82	62	18
1961	359.89	82	79	18
1971	400	80	100	20
1981	450	75	150	25

Let's solve the options one by one .

Option A : 1971-81  $\frac{150-100}{100} = 0.5$

Option B : 1961-71  $\frac{100-79}{79} = 0.266$

Option C : 1951-61  $\frac{79-62}{62} = 0.274$

Option D : 1941-1951  $\frac{62-44}{44} = 0.41$

Among the above values, the largest rate of increase in urban population occurred during 1971-81

Hence A is the correct answer.

#### Question 24

The rate of urban population growth per year over the period 1901-81 is about

- A 0.65 million
- B 1.56 million
- C 2.65 million
- D 15.62 million

Answer: A

Explanation:

Year	Rural population	% of Rural population	Urban population	% of Urban population
1901	225	90	25	10
1911	234	90	26	10
1921	226.54	89	28	11
1931	242	88	33	12
1941	270.29	86	44	14
1951	282.44	82	62	18
1961	359.89	82	79	18
1971	400	80	100	20
1981	450	75	150	25

from the table

Rate of urban growth per year over the period 1901-81 =  $\frac{150}{25 \times 9}$

$$= \frac{150}{225}$$

=0.66 million

Hence A is the correct answer.

#### Question 25

The smallest rate of increase in urban population in a decade during 1921-1961 occurred in

- A 1951-61
- B 1941-51
- C 1931-41
- D 1921-31

Answer: A

Explanation:

Year	Rural population	% of Rural population	Urban population	% of Urban population
1901	225	90	25	10
1911	234	90	26	10
1921	226.54	89	28	11
1931	242	88	33	12
1941	270.29	86	44	14
1951	282.44	82	62	18
1961	359.89	82	79	18
1971	400	80	100	20
1981	450	75	150	25

Let's solve the options one by one ,

Option A :Rate of increase of urban population during 1951-61 =  $\frac{79-62}{62} = 0.274$

Option B :Rate of increase of urban population during 1941-51 =  $\frac{62-44}{44} = 0.409$

Option C :Rate of increase of urban population during 1931-41 =  $\frac{44-33}{33} = 0.33$

Option D :Rate of increase of urban population during 1921-31 =  $\frac{12-11}{11} = 0.091$

Among the above values smallest rate of increase was during 1951-61

Hence A is the correct answer.

## Quant

### Instructions

For the following questions answer them individually

### Question 26

If  $a \in R$ , then the equation  $x^2 + x + a = 0$  and  $x^2 + ax + 1 = 0$  have a common real root for

- A no value of a
- B exactly one value of a in the interval [0,2]
- C exactly one value of a in the interval [-3,-1]
- D exactly two values of a

**Answer:** C

### Explanation:

Let ' $\alpha$ ' be the common root which satisfies both the equations.

$$\alpha^2 + \alpha + a = 0 \text{ and } \alpha^2 + a\alpha + 1 = 0$$

On subtracting the equations,

$$a(\alpha - 1) + 1 - a = 0$$

$$\alpha = 1$$

Substitute the value of  $\alpha$  in any of the equations, we get

$$a = -2$$

C is the correct answer.

Question 27

A man standing  $x$  metres north of A tower finds the angle of elevation of as top to be  $30^\circ$  .He then starts walking towards the tower. After walking a distance of  $x/2$  metres, he turns east and walks another  $x/2$  metres. Then he turns south and walks another  $x/2$  metres. The angle of elevation of the top of the tower from his new position is

- A  $15^\circ$
- B  $60^\circ$
- C  $\tan^{-1} \sqrt{\frac{2}{3}}$
- D  $\tan^{-1} \frac{2}{\sqrt{3}}$

Answer: E

Question 28

Let the equations of two circles  $C_1$  and  $C_2$  be given by  $x^2 + y^2 - 4x - 4y + 6 = 0$  and  $x^2 + y^2 - 10x - 10y + k = 0$  respectively, where  $k$  is a constant. Suppose that  $C_1$  and  $C_2$  have exactly two common tangents. Then possible values of  $k$  are

- A  $0 < k < 18$
- B  $18 < k < 42$
- C  $42 < k < 50$
- D none of the above

Answer: B

Explanation:

Centre and radius of a circle  $x^2 + y^2 + 2gx + 2fy + c = 0$  is  $(-g,-h)$  and  $\sqrt{g^2 + h^2 - c}$

Centre and the radius of  $C_1$  is  $(2,2)$  and  $\sqrt{2}$

Centre and the radius of  $C_2$  is  $(5,5)$  and  $\sqrt{50 - k}$

Distance between the centres of the two circles =  $\sqrt{18}$

According to the properties of the circle

If two circles have two common tangents then ,

|Difference of the radii| < Distance between the centres of the two circles < |Sum of the radii|

$$\sqrt{50 - k} - \sqrt{2} < \sqrt{18} < \sqrt{50 - k} + \sqrt{2}$$

Let's look at the options one by one ,

Option A : let  $k = 1$   $|7 - \sqrt{2}| < 3\sqrt{2} < |7 + \sqrt{2}|$  -----> Does not satisfy

Option B : let  $k = 25$   $|5 - \sqrt{2}| < 3\sqrt{2} < |5 + \sqrt{2}|$  -----> Satisfied

Option C : let  $k = 49$   $|1 - \sqrt{2}| < 3\sqrt{2} < |1 + \sqrt{2}|$  -----> Does not satisfy

Hence B is the correct answer.

Question 29

Consider the function

$$f(x) = \begin{cases} 2x - 1 & \text{if } x < -1 \\ x^2 + 1 & \text{if } -1 \leq x \leq 1 \\ x + 1 & \text{if } x > 1. \end{cases}$$

Then

- A  $f$  is continuous everywhere

- B  $f$  is continuous everywhere except  $x = -1$  and  $x = 1$
- C  $f$  is continuous everywhere except  $x = -1$
- D  $f$  is continuous everywhere except  $x = 1$

**Answer: C**

**Explanation:**

$F(x) =$

$$\lim_{x \rightarrow -1^-} (2x-1) = 2(-1)-1 = -3$$

$$\lim_{x \rightarrow -1^+} (x^2 + 1) = 1+1 = 2$$

Since the left-hand limit and right-hand limit are not equal, the function is discontinuous at -1.

$$\lim_{x \rightarrow 1^-} (x^2 + 1) = 1+1 = 2$$

$$\lim_{x \rightarrow -1^+} x+1 = 1+1 = 2$$

Since the left-hand limit and right-hand limit are equal, the function is continuous at 1.

So the function is continuous everywhere except at -1.

C is the correct answer.

**Question 30**

The sum of the first 50 terms of the series:  $3 + 7 + 13 + 21 + 31 + 43 + \dots$  is

- A  $50 \times 870$
- B  $50 \times 875$
- C  $50 \times 880$
- D  $50 \times 885$

**Answer: D**

**Explanation:**

$$3 + 7 + 13 + 21 + 31 + 43 + \dots$$

The difference of two consecutive terms is 4,6,8,10

Since the difference of two consecutive terms is in AP, the general term will be a quadratic expression in  $n$

So the general term is  $t(n) = an^2 + bn + c$

$$t(1) = a+b+c = 3$$

$$t(2) = 4a+2b+c = 7$$

$$t(3) = 9a+3b+c = 13$$

we get the values of  $a, b, c$  as 1,1,1 respectively

$$\text{General term} = 1n^2 + n + 1$$

$$\sum 1n^2 + n + 1 = n \left( \frac{n^2+3n+5}{3} \right)$$

Substitute  $n = 50$

$$= 50 \times 885$$

Hence D is the correct answer.

**Question 31**

If

$$A_n = \frac{1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + 3 \cdot 4 \cdot 5 + \dots \text{upto } n \text{ terms}}{n(1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots \text{upto } n \text{ terms})}$$

then  $\lim_{n \rightarrow \infty} A_n$  is

- A  $\frac{3}{4}$
- B  $\frac{1}{4}$

C  $\frac{1}{2}$

D  $\frac{5}{4}$

Answer: E

**Question 32**

The function  $f : R \rightarrow R$ , defined by  $f(x) = x^3 - 3x^2 + 6x - 5$ , is

A one-to-one, but not onto

B one-to-one and onto

C onto, but not one-to-one

D neither one-to-one nor onto

Answer: E

**Question 33**

The number of distinct words that can be formed using all the letters except vowels of the word 'PROBABILITY' is

A 2520

B 5040

C  $\frac{9!}{2!}$

D  $\frac{11!}{4}$

Answer: A

**Explanation:**

The letters except the vowels are P, R, B, B, L, T, Y.

The number of words that can be formed =  $\frac{7!}{2} = 2520$

A is the correct answer.

**Question 34**

The area enclosed between the curves  $y = 2x^2$  and  $y = 6$  is

A  $2\sqrt{3}$

B  $4\sqrt{3}$

C  $6\sqrt{3}$

D  $8\sqrt{3}$

Answer: B

**Explanation:**

$y = 2x^2$  and  $y = 6$

$6 = 2x^2$

$x = -\sqrt{3}$  and  $\sqrt{3}$

$$\int_{-\sqrt{3}}^{\sqrt{3}} 2 * x^2$$

Since  $x^2$  is an even function

$$\int_{-\sqrt{3}}^{\sqrt{3}} 2 * x^2$$

$$= 4 \int_0^{\sqrt{3}} x^2$$

$$= 4 * \frac{x^3}{3} \text{ where } x \text{ varies from } 0 \text{ to } \sqrt{3}$$

$$= 4\sqrt{3}$$

**Question 35**

The value of  $\lim_{x \rightarrow 0} \frac{\sin(x^2)}{x \sin x}$  is

- A 0
- B 1
- C 2
- D  $\infty$

**Answer: B**

**Explanation:**

We know that  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$  is 1

$$= \lim_{x \rightarrow 0} \frac{\sin x^2}{x^2} * \frac{x}{\sin x}$$

$$= 1$$

**Question 36**

The value of  ${}^{30}C_2 + {}^{30}C_4 + {}^{30}C_6 + \dots + {}^{30}C_{29}$  is

- A  $\frac{2^{31}}{30}$
- B  $\frac{2^{30}}{31}$
- C  $\frac{2^{31}-1}{31}$
- D  $\frac{2^{30}-1}{31}$

**Answer: B**

**Explanation:**

We know that  $(1+x)^n = {}^nC_0 * 1^n + {}^nC_1 * 1^{n-1} * x + \dots + {}^nC_n * x^n$

On Integrating, we get

$$\frac{(1+x)^{n+1}}{n+1} = \frac{{}^nC_0 * 1^{n+1}}{1} + \frac{{}^nC_1 * 1^{n-1} * x}{2} + \dots + \frac{{}^nC_n * x^n}{n+1}$$

When  $x = 1$

$$2^{31} = 1 + 2 + 3 + 4 + \dots + 30 + 31 \text{ -- Eq 1}$$

When  $x = -1$

$$0 = 1 - 2 + 3 - 4 + \dots + 30 - 31 \text{ -- Eq 2}$$

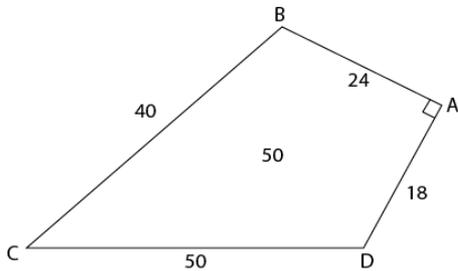
Adding Eq 1 and 2, we get

$$2^{31} = 2( {}^{30}C_1 + {}^{30}C_3 + {}^{30}C_5 + \dots + {}^{30}C_{29} )$$

$$({}^{30}C_1 + {}^{30}C_3 + {}^{30}C_5 + \dots + {}^{30}C_{29} + 2^{30}) = 31$$

**Question 37**

In the quadrilateral  $ABCD$  below,  $\angle DAB = 90^\circ$  and  $AB = 24\text{cm}$ ,  $BC = 40\text{cm}$ ,  $CD = 50\text{cm}$  and  $AD = 18\text{cm}$ (The diagram is not drawn to scale) Find the area of the quadrilateral



A  $1089\text{ cm}^2$

B  $914\text{ cm}^2$

C  $816\text{ cm}^2$

D  $726\text{ cm}^2$

**Answer: C**

**Explanation:**

Join BD

Area of ABCD = area of ABD + area of BCD

In ABD  $AB^2 + AD^2 = BD^2$

Therefore  $24^2 + 18^2 = BD^2$ , on solving  $BD = 30$

also  $30^2 + 40^2 = 50^2$  which implies BCD is also a right-angled triangle

Area of ABD =  $\frac{1}{2} \times 24 \times 18 = 216$

Area of BCD =  $\frac{1}{2} \times 30 \times 40 = 600$

Area of ABCD = 816

**Question 38**

Let  $x = \frac{\pi}{4}$ . Then the value of  $\cot x \cot 2x \cot 3x \dots \cot 19x$  is

A 1

B -1

C 0

D  $\infty$

**Answer: D**

**Explanation:**

$\cot(2x) = \cot(90) = 0$

$\cot(4x) = \cot(\pi) = \text{infinity}$

So  $0 \times \text{infinity}$  is undefined

Therefore the option is D

**Question 39**

Consider the function:  $f(x) = |2 - |x - 1||$  for all  $x \in R$ . Then the value of  $f'(-2) + f'(0) + f'(2) + f'(4)$  is

- A -2
- B 0
- C 1
- D 2

Answer: B

Explanation:

$$|x - 1|$$

$$= \begin{cases} x - 1 & x \geq 1 \\ 1 - x & x < 1 \end{cases}$$

$$x < 1 \quad f(x) = |x + 1|$$

$$x \geq 1 \quad f(x) = |3 - x|$$

$$x < -1 \quad f(x) = -x - 1$$

$$x \geq -1 \quad f(x) = x + 1$$

$$x < 3 \quad f(x) = x - 3$$

$$x \geq 3 \quad f(x) = 3 - x$$

Calculate the values of

$$f'(-2) = -1, f'(0) = 1, f'(2) = 1, f'(4) = -1$$

$$f'(-2) + f'(0) + f'(2) + f'(4) = 0$$

Hence B is the correct answer.

**Question 40**

Let

$$P = \begin{bmatrix} a & b & 0 \\ -1 & 2 & 1 \\ 2 & -3 & -2 \end{bmatrix}$$

with  $\det(P) = -2$ . Then the minor  $M_{22}$  of  $P$  is

- A -4
- B -2
- C 2
- D 4

Answer: A

Explanation:

$$\det(P) = a(2 \cdot -2) - (-3 \cdot 1) + (-b)[(-1 \cdot -2) - (2 \cdot 1)] + 0[(-1 \cdot -3) - (2 \cdot 2)]$$

$$= a(-4) - b(0)$$

= -a

But given  $\det(P) = -2$

Hence  $a = 2$

Minor of  $M_{22} = \det \begin{bmatrix} a & 0 \\ 2 & -2 \end{bmatrix}$

$\det$  of  $\begin{bmatrix} 2 & 0 \\ 2 & -2 \end{bmatrix}$

= -4

Hence A is the correct answer.

#### Question 41

If  $\alpha$  and  $\beta$  are two roots of the equation  $x^2 + x + 1 = 0$ , then the value of  $\alpha^{2017} + \beta^{2017}$  is

A 0

B 1

C -1

D 2

Answer: C

#### Explanation:

Consider,  $x^3 - 1 = (x-1)(x^2 + x + 1) = 0$

It will have roots as 1,  $\alpha$  and  $\beta$

Now, since both  $\alpha$  and  $\beta$  satisfy  $x^3 - 1 = 0$ , Hence,  $\alpha^3 - 1 = 0 \Rightarrow \alpha^3 = 1$

and  $\beta^3 - 1 = 0 \Rightarrow \beta^3 = 1$

Hence  $\alpha^{2017} + \beta^{2017} = \alpha^{3 \times 672 + 1} + \beta^{3 \times 672 + 1} = \alpha + \beta$

Now, the sum of roots of the equation  $x^3 - 1 = 0$  is zero.

Hence,  $1 + \alpha + \beta = 0 \Rightarrow \alpha + \beta = -1$

#### Question 42

The number of different solutions  $(x, y, z)$  of the equation  $x + y + z = 10$ , where  $x, y$  and  $z$  are positive integers, is

A 36

B 121

C 990

D 75

Answer: E

#### Explanation:

Assume  $x = a + 1, y = b + 1, z = c + 1$

$a + 1 + b + 1 + c + 1 = 10,$

$a + b + c = 7$

The number of non-negative solutions for  $a, b$  and  $c$  will give the positive integral solution for  $x, y, z$  which is  ${}^{7+3-1}C_{3-1} = \frac{9 \times 8}{2} = 36$

**Question 43**

In the  $xy$ -plane, the equation  $x^2 - y^2 = 2y + 1$  represents a

- A parabola
- B hyperbola
- C point
- D pair of straight lines

**Answer:** D

**Explanation:**

We have,  $x^2 - y^2 = 2y + 1$

$$\Rightarrow x^2 = y^2 + 2y + 1$$

$$\Rightarrow x^2 - (y+1)^2 = 0$$

$$\Rightarrow (x-y-1)(x+y+1) = 0$$

Here we have pair of straight lines.

**Question 44**

There are 100 students in a class. In an examination, 50 of them failed in Mathematics, 45 failed in Physics and 40 failed in Biology. 32 failed in exactly two of the three subjects. Only one student passed in all the subjects. The number of students failing in all the three subjects is

- A 12
- B 4
- C 2
- D cannot be determined

**Answer:** C

**Explanation:**

Assume the number of students who failed in exactly 1 subject is  $x$

The number of students who failed in exactly 2 subjects is  $y$

The number of students who failed in exactly 3 subjects is  $z$

$$\text{Now, } x + 2y + 3z = 50 + 45 + 40 = 135$$

$$x + y + z = 100 - 1 = 99$$

On subtracting the two equations, we get,

$$y + 2z = 36$$

It is given that  $y = 32$

$$\text{Hence, } 2z = 36 - 32 = 4 \Rightarrow z = 2$$

**Question 45**

The point  $R(4, 10)$  lies on the curve  $C: y = x^2 - 6x + 18$ . The tangent and normal to  $C$  at  $R$  meet the  $Y$ -axis at points  $P$  and  $Q$  respectively. A circle passes through the points  $P, Q$  and  $R$ . The radius of this circle is

- A 3
- B 4
- C 5

D 6

Answer: C

Explanation:

$$\frac{dy}{dx} = 2x - 6$$

Slope of the tangent at R(4, 10) = 2

A normal will be perpendicular to tangent, so the slope of the normal =  $-\frac{1}{2}$

Equation of the tangent at R(4, 10) =

$$y - 10 = 2(x - 4)$$

$$y = 2x + 2$$

The above line intersects Y-axis at P (0,2)

Equation of the normal at R(4, 10) =

$$y - 10 = -\frac{1}{2}(x - 4)$$

$$2y = -x + 24$$

The above line intersects Y-axis at Q (0,12)

Let the equation of the circle be  $x^2 + y^2 + 2gx + 2fy + c = 0$  with centre (-g, -f)

Now we have to find the equation of the circle passing through P (0, 2), Q(0, 12), R(4, 10)

On substituting these values in the equation of the circle, we get  $g = 0, f = -7, c = 24$

$$\text{Radii of the circle} = \sqrt{g^2 + f^2 - c}$$

$$= 5$$

Question 46

An equilateral triangle, having each side as  $a$ , has its corners cut away so as to form a regular hexagon. The area of the hexagon is

A  $\frac{\sqrt{3} a^2}{6}$

B  $\frac{2\sqrt{3} a^2}{3}$

C  $\frac{\sqrt{3} a^2}{12}$

D  $\frac{\sqrt{3} a^2}{4}$

Answer: E

Explanation:

To make a regular hexagon, three equilateral triangles of side  $\frac{a}{3}$  will be cut from the corners to make a regular hexagon of side  $a$ .

Hence, this hexagonal can be further divided into 6 equilateral triangles of side  $\frac{a}{3}$ .

$$\text{Hence the area of the hexagon} = 6 \cdot \frac{\sqrt{3}}{4} \left(\frac{a}{3}\right)^2 = \frac{\sqrt{3} a^2}{6}$$

A is the answer.

Question 47

Let  $f(x) = a_0 + a_1 x + a_2 x^2 + a_3 x^3$ , where  $a_0, a_1, a_2$  and  $a_3$  are constants. Which of the following statements is correct?

A  $f(x)$  is differentiable at  $x = 0$  for any choice of  $a_0, a_1, a_2$  and  $a_3$

B  $f(x)$  is not differentiable at  $x = 0$  for any choice of  $a_0, a_1, a_2$  and  $a_3$

C If  $f(x)$  differentiable at  $x = 0$ , then  $a_1 = 0$

D If  $f(x)$  differentiable at  $x = 0$ , then  $a_1 = 0$  and  $a_3 = 0$

Answer: D

**Explanation:**

For the function to be differentiable at  $x=0$ ,  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$   
 $\Rightarrow f'(0) = \lim_{h \rightarrow 0} \frac{f(h) - f(0)}{h}$

Now using the value of  $f(x)$ , we get  $f'(0) = \lim_{h \rightarrow 0} \frac{a_0 + a_1h + a_2h^2 + a_3h^3}{h}$

Now,  $f'(0) = \lim_{h \rightarrow 0} \frac{a_1h + a_2h^2 + a_3h^3}{h}$

For  $h < 0$ ,  $f'(0) = -a_1 + a_2h - a_3h^2$

For  $h > 0$ ,  $f'(0) = a_1 + a_2h + a_3h^2$

So for  $h \rightarrow 0$ , the two values will only be equal if  $a_1 = 0$  and  $a_3 = 0$

Hence, C is the answer.

**Question 48**

If  $P = \begin{pmatrix} a & b & c \\ x & y & z \\ p & q & r \end{pmatrix}$  and  $Q = \begin{pmatrix} -x & a & -p \\ y & -b & q \\ z & -c & r \end{pmatrix}$  then

A  $\det(P) = \det(Q)$

B  $\det(P) = 2\det(Q)$

C  $2\det(P) = \det(Q)$

D  $\det(P) = -\det(Q)$

Answer: D

**Explanation:**

Taking -1 common from both 2nd and 3rd row of Q, we get

$$Q = (-1)(-1) \begin{pmatrix} -x & a & -p \\ -y & b & -q \\ -z & c & -r \end{pmatrix} = \begin{pmatrix} -x & a & -p \\ -y & b & -q \\ -z & c & -r \end{pmatrix}$$

Now taking -1 common from 1st and 3rd column of Q, we get

$$Q = (-1)(-1) \begin{pmatrix} x & a & p \\ -y & b & q \\ z & c & r \end{pmatrix} = \begin{pmatrix} x & a & p \\ -y & b & q \\ z & c & r \end{pmatrix}$$

After interchanging the 1st and second column, Q becomes the the transpose of P.

Since the row have been exchange once and the determinant of the transpose matrix is the same, hence  $\det(P) = (-1)^1 \det(Q)$   
 $\Rightarrow \det(P) = -\det(Q)$

D is the answer.

**Question 49**

Let  $S = \{1, 2, \dots, 100\}$ . The number of nonempty subsets T of S such that the product of numbers in T is even is

A  $2^{50}(2^{50} - 1)$

B  $2^{100} - 1$

C  $2^{50} - 1$

D  $2^{51} - 1$

Answer: A

**Explanation:**

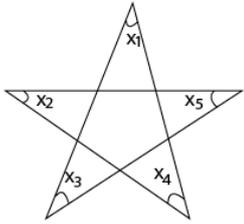
The number of ways to select non-empty set out of  $S = 100C_1 + 100C_2 + 100C_3 + \dots + 100C_{100} = 2^{100} - 1$

Similarly, the number of ways to select non-empty set from (say)  $P = \{1, 3, 5, 7, 9, \dots, 99\} = 2^{\{50\}} - 1$

Hence, the required number of set =  $2^{\{100\}} - (2^{\{50\}} - 1) = 2^{\{50\}} \cdot (2^{\{50\}} - 1) + 1$

**Question 50**

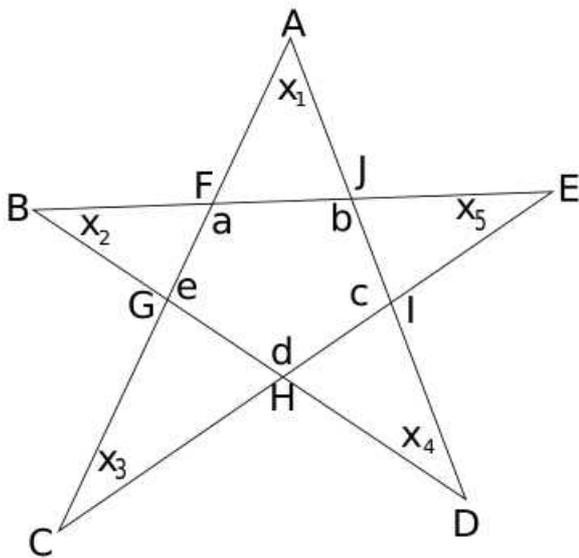
What is the sum of the interior angles at the vertices of a 5-pointed star as shown below? The star need not have sides of the same length.



- A  $120^\circ$
- B  $180^\circ$
- C  $540^\circ$
- D depends on the sides of the star.

**Answer: B**

**Explanation:**



In triangle AFJ,  $x_1 + 180 - a + 180 - b = 180$

$$\Rightarrow x_1 + 180 = a + b$$

Similarly,  $x_2 + 180 = a + e$

$$x_3 + 180 = d + e$$

$$x_4 + 180 = c + d$$

$$x_5 + 180 = b + c$$

Adding all the equations,

$$x_1 + x_2 + x_3 + x_4 + x_5 + 180 \cdot 5 = 2(a + b + c + d + e)$$

$$\Rightarrow \text{Sum of interior angles} = 2(a + b + c + d + e) - 900 = 2 \cdot 540 - 900 = 180 \quad (\text{Sum of interior angles of a pentagon} = 540)$$

