Term 1 - Full Test

Subject: Mathematics

Time: 01:30 hrs

Instructions:

- The question paper contains three sections.
- Section A (**1 - 20**) has 20 questions. Attempt any 16 questions.
- Section B (**21 - 40**) has 20 questions. Attempt any 16 questions.
- Section C (**41 - 50**) has 10 questions based on two Case Studies. Attempt any 8 questions.
- All questions carry equal marks.
- There is no negative marking.

1. Using Euclid's division lemma, find the HCF of 1848, 3058 and 1331.

✓ **A.** 11

✗ **B.** 13

✗ **C.** 14

✗ **D.** 9

Consider first two numbers 1848 and 3058, where 3058 > 1848.

By Euclid's division lemma :

$3058 = 1848 \times 1 + 1210$

$1848 = 1210 \times 1 + 638$

$1210 = 638 \times 1 + 572$

$638 = 572 \times 1 + 66$

$572 = 66 \times 8 + 44$

$66 = 44 \times 1 + 22$

$44 = 22 \times 2 + 0$

$\therefore$ HCF of 1848 and 3058 is 22.

Let us now find the HCF of the numbers 1331 and 22.

$1331 = 22 \times 60 + 11$

$22 = 11 \times 2 + 0$

HCF of 1331 and 22 is 11.

$\therefore$ HCF of the numbers 1848, 3058 and 1331 is 11.

2. The difference of two numbers is 1365. On dividing the larger number by the smaller, we get 6 as quotient and 15 as remainder. What is the smaller number ?

☒ **A.** 240
☑ **B.** 270
☒ **C.** 295
☒ **D.** 360

Let the smaller number be x.

$\Rightarrow$ Larger number = $x + 1365$

By Euclid's division lemma, the larger number can also be written as $6x + 15$.

$\Rightarrow x + 1365 = 6x + 15$
$\Rightarrow 5x = 1350$
$\Rightarrow x = 270$

$\therefore$ The smaller number is 270 and the larger number is 270 + 1365 = 1635.

3. Find the largest number which can divide both 324 and 144.

☒ **A.** 21
☒ **B.** 9
☑ **C.** 36
☒ **D.** 18

The largest number that can divide both 324 and 144 is the HCF of both the numbers.

Prime factorising the two numbers we get,

$324 = 2 \times 2 \times 3 \times 3 \times 3 \times 3$
$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

Now, taking the common factors between them will give us the HCF.

$\therefore$ HCF $= 2 \times 2 \times 3 \times 3 = 36$

4. 1400^n is NOT divisible by which of the following, if n is a natural number:

☒ **A.** 100

☒ **B.** 175

☒ **C.** 56

☑ **D.** 210

1400^n =$(2^3 5^2 7)^n$

For any ‘n’, 1400^n has factors 8, 25, 7, (25 × 4 = 100), (25 × 7 = 175), (7 × 8 = 56), but 210 = 3 × 7 × 10, which can not be structured from the prime factors of 1400.

So this is not divisible by 210.

5. There is a circular track with the distance of track from centre as 10 m. Ram runs a distance of 21 m on the track. What is the angle in degrees covered by Ram with respect to the centre of track?

☒ **A.** 76°

☑ **B.** 63°

☒ **C.** 56°

☒ **D.** 90°

The radius of circle is the distance of track from centre = 10 m

The path covered by Ram is the arc Length = 21 m

Angular displacement (in degrees)

$$= \frac{Arc\ length}{Circumference} \times\ 360^\circ = \frac{21}{2\pi r} \times\ 360^\circ$$

$$= \frac{11 \times 7}{2 \times 22 \times 10} \times\ 360^\circ = 63^\circ$$

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6. Ritu can row downstream 20 km in 2 hours, and upstream 4 km in 2 hours. Find her speed of rowing in still water and the speed of the current.

✓ **A.** (6,4)

✗ **B.** (4,6)

✗ **C.** (8,12)

✗ **D.** (12,8)

Let the speed of the boat in still water be $x\ \frac{km}{hr}$ and speed of the stream be $y\ \frac{km}{hr}$.

Then the speed of the boat downstream = $(x+y)\frac{km}{hr}$,

The speed of the boat upstream = $(x-y)\frac{km}{hr}$

Also, $Speed = \frac{(distance)}{(time)}$

In first case Ritu covers a distance of 20 Km downstream in 2 hours

$\therefore x+y=\frac{20}{2}$

$\Rightarrow x+y=10$.....(1)

In the other case Ritu covers a distance of 4 km upstream in 2 hours

$\therefore x-y=\frac{4}{2}$

$\Rightarrow x-y=2$.....(2)

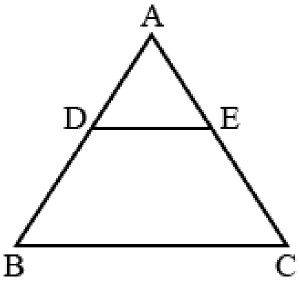
Solving the equations by elimination method.

Adding (1) and (2) we get $2x=12 \Rightarrow x=6$

Substituting in one of the equation we get $6+y=10 \Rightarrow y=4$

Hence speed of rowing in still water is $6\ \frac{km}{hr}$ and the speed of the current is $4\ \frac{km}{hr}$.

7. In ∆ABC, if DE divides AB and AC in the same ratio, then which of the following options is true?

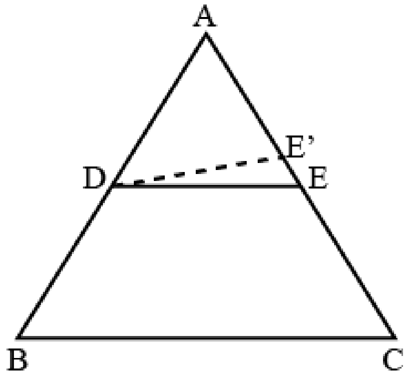


☒ **A.** AD = AE

☒ **B.** AD = DB

☑ **C.** DE and BC are parallel

☒ **D.** DE is half of BC



Construction: Draw DE' parallel to BC as shown in the figure above.

Since, DE' II BC,

$\frac{AD}{DB} = \frac{AE'}{E'C}$ ... (i) [by Basic Proportionality Theorem]

But we are given that AD divides AB and AC in the same ratio then

$\frac{AD}{DB} = \frac{AE}{EC}$ ...(ii)

From (i) and (ii), we get

$\frac{AE'}{E'C} = \frac{AE}{EC}$

Adding 1 to both sides further, we get

$\frac{AE'}{E'C} + 1 = \frac{AE}{EC} + 1$

$\frac{AC}{E'C} = \frac{AC}{EC}$

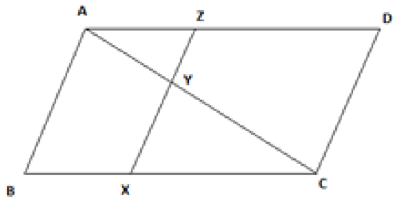
$E'C = EC$

This is possible only if E' and E coincide. (Since E' and E lie on the same line)

This implies DE' = DE

Hence, DE $\|$ BC.

8. $ABCD$ is a parallelogram with diagonal AC. If a line XZ is drawn such that $XZ \parallel AB$ and cuts AC at Y then, find $\frac{BX}{XC}$.



☒ **A.** $\frac{AY}{AC}$

☒ **B.** $\frac{DZ}{AZ}$

☑ **C.** $\frac{AZ}{ZD}$

☒ **D.** $\frac{AC}{AY}$

In the Δ ABC,

$AB \parallel XZ$

$\Rightarrow AB \parallel XY$

$\therefore \frac{BX}{XC} = \frac{AY}{YC} \ldots (1)$ [By Basic Proportionality Theorem]

In parallelogram ABCD,
AB || CD

AB || CD || XZ

In the Δ ACD,
CD || YZ

$\therefore \frac{AY}{YC} = \frac{AZ}{ZD} \ldots (2)$ [By Basic Proportionality Theorem]

From 1 & 2,
$\frac{BX}{XC} = \frac{AY}{YC} = \frac{AZ}{ZD}$

$\frac{BX}{XC} = \frac{AZ}{ZD}$

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9. Find the trigonometric ratio equivalent to the following:

$sin55^\circ + cos20^\circ + cot70^\circ + cosec85^\circ$

☒ **A.** $cos35^\circ + sin20^\circ + tan20^\circ + sec5^\circ$

✓ **B.** $cos35^\circ + sin70^\circ + tan20^\circ + sec5^\circ$

☒ **C.** $cos35^\circ + sin20^\circ + tan70^\circ + sec5^\circ$

☒ **D.** $cos35^\circ + sin20^\circ + tan70^\circ + sec85^\circ$

Since,

$sinA = cos(90^\circ - A)$

$cosA = sin(90^\circ - A)$

$cosecA = sec(90^\circ - A)$

$cotA = tan(90^\circ - A)$

$Hence, sin55^\circ + cos20^\circ + cot70^\circ + cosec85^\circ$
$= cos(90^\circ - 35^\circ) + sin(90^\circ - 70^\circ) + tan(90^\circ - 20^\circ) + sec(90^\circ - 5^\circ)$
$= cos35^\circ + sin70^\circ + tan20^\circ + sec5^\circ$

10. If in a right-angled triangle ABC angles A and B are acute, then evaluate

$1 + \frac{tanA}{tanB} =$

✗ **A.** 1

✓ **B.** sec^2A

✗ **C.** secA

✗ **D.** 2

Given, in a right-angled triangle ABC angles A and B are acute.

Hence, A + B = 90°.

So, $1 + \frac{tan(90^\circ - B)}{tanB}$ $\quad \ldots[\tan(90-\theta) = \cot\theta]$

$= 1 + \frac{cotB}{tanB}$

We know $\frac{1}{tanB} = cotB$

$= 1 + \cot^2 B$

$= 1 + cot^2(90^\circ - A)$

$= 1 + tan^2A$

$= sec^2A \qquad (sec^2A - tan^2A = 1)$

11. A card is drawn from a well-shuffled deck of playing cards. Find the probability of drawing a black card which is neither a face card nor an ace?

✗ **A.** $\frac{9}{52}$

✓ **B.** $\frac{9}{26}$

✗ **C.** $\frac{9}{13}$

✗ **D.** $\frac{10}{13}$

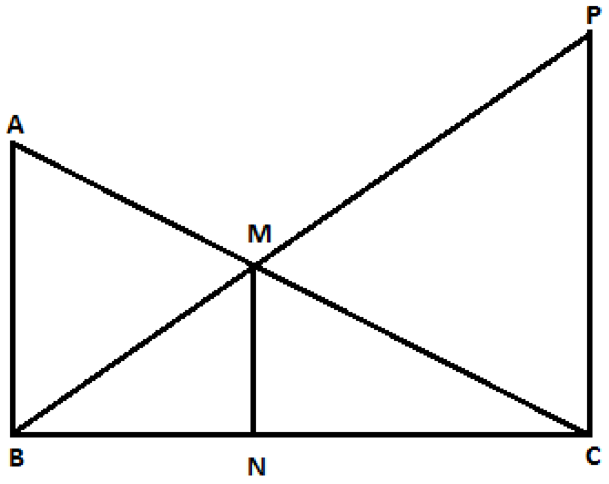
In each suit, there are 9 cards that are not face cards and ace.

Hence, there will be a total of 18 cards in a deck which are black and are not face cards and ace.

We know that, Probability of an event E, P(E) = $\frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$

$\therefore$ Required probability is $\frac{18}{52} = \frac{9}{26}$.

12.



In the above figure, $AB \parallel MN \parallel PC$, then which of the following will be true?

✗ **A.** $\frac{1}{MN} + \frac{1}{PC} = \frac{1}{AB}$

✗ **B.** $\frac{1}{AB} + \frac{1}{MN} = \frac{1}{PC}$

✓ **C.** $\frac{1}{AB} + \frac{1}{PC} = \frac{1}{MN}$

✗ **D.** $\frac{1}{AB} - \frac{1}{PC} = \frac{1}{MN}$

In $\triangle MNC \text{ and } \triangle ABC$
$\angle MNC = \angle ABC = 90^\circ$
$\angle MCN = \angle ACB \quad \text{(Common angle)}$

Therefore, $\triangle MNC \sim \triangle ABC$ by AA similarity

So, $\frac{MN}{AB} = \frac{NC}{BC}$ ---- I

In $\triangle MNB \text{ and } \triangle PCB$
$\angle MNB = \angle PCB = 90^\circ$
$\angle MBN = \angle PBC \quad \text{(Common angle)}$

Therefore, $\triangle MNB \sim \triangle PCB$ by AA similarity.
So, $\frac{MN}{PC} = \frac{BN}{BC}$ --- II

Adding I and II,
$\frac{MN}{AB} + \frac{MN}{PC} = \frac{NC}{BC} + \frac{BN}{BC}$

$MN\,[\frac{1}{AB} + \frac{1}{PC}] = \frac{BC}{BC}$
$\Rightarrow \frac{1}{AB} + \frac{1}{PC} = \frac{1}{MN}$

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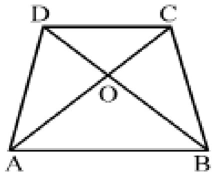
13.



In this figure, ABCD is a trapezium in which AB || DC and AB = 3DC. Determine the ratio of the areas of △ AOB and △COD.

☒ **A.** 4 : 1

☒ **B.** 16 : 1

☒ **C.** 3 : 4

✓ **D.** 9 : 1

In △ AOB and △ COD, we have

$\angle AOB = \angle COD$ [Vertically opposite angles]

And, $\angle OAB = \angle OCD$ [Alternate angles]

So, by AA-criterion of similarity, we have $\triangle AOB \sim \triangle COD$.

$$\frac{area\ of\ \triangle AOB}{area\ of\ \triangle COD} = \frac{(AB)^2}{(DC)^2}$$

We know that, $AB = 3DC$.

Then, $\frac{area\ of\ \triangle AOB}{area\ of\ \triangle COD} = \frac{(3DC)^2}{DC^2} = \frac{9}{1}$

Hence, Area (△AOB) : Area (△COD) = 9 : 1

14. Which of the following has a non terminating decimal expansion?

☑ **A.** $\frac{17}{210}$

☒ **B.** $\frac{23}{8}$

☒ **C.** $\frac{17}{80}$

☒ **D.** $\frac{35}{50}$

A rational number in the form of $\frac{p}{q}$ is a terminating decimal if q can be expressed as $2^m \times 5^n$ where m and n are non negative positive integers.

$\frac{17}{210}$’
Here, q = 210 = $2 \times 3 \times 5 \times 7$
since denominator is not in the form of $2^m \times 5^n$, the rational number has non terminating decimal expansion.

$\frac{23}{8}$
Here, 8 = $2^3 \times 5^0$
$\therefore$ The rational number has terminating decimal expansion.

$\frac{17}{80}$
Here, 80= $2^4 \times 5^1$
The rational number has terminating decimal expansion.

$\frac{35}{50}$
50 = $2 \times 5 \times 5$

The rational number has terminating decimal expansion. Hence $\frac{11}{210}$ is the non-terminating decimal expansion among the given options.

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15. The decimal expansion of $\frac{141}{120}$ will terminate after how many places?

- ✓ **A.** 3
- ✗ **B.** 5
- ✗ **C.** 7
- ✗ **D.** Will not terminate

Given rational number $\frac{141}{120}$

Here, $120 = 2^3 \times 3 \times 5$

$141 = 3 \times 47$

$\Rightarrow \frac{141}{120} = \frac{3\times47}{2^3\times3\times5}$

$= \frac{47}{2^3\times5}$

Multiply and divide by 5^2.

$= \frac{47\times5^2}{2^3\times5\times5^2}$

$= \frac{47\times25}{(2\times5)^3}$

$= \frac{1175}{1000}$

= 1.175

Therefore, $\frac{141}{120}$ will terminate after three decimal places.

16. The value of $(1+cot\theta-cosec\theta)(1+tan\theta+sec\theta)$ is

✗ **A.** 1

✓ **B.** 2

✗ **C.** 4

✗ **D.** 0

$(1+cot\theta-cosec\theta)(1+tan\theta+sec\theta)$
$=1+tan\theta+sec\theta+cot\theta+cot\theta tan\theta+cot\theta sec\theta-cosec\theta-cosec\theta tan\theta-cosec\theta sec\theta$
$=1+tan\theta+sec\theta+cot\theta+(\frac{1}{tan\theta}\times tan\theta)+(\frac{cos\theta}{sin\theta}\times\frac{1}{cos\theta})-cosec\theta-(\frac{1}{sin\theta}\times\frac{sin\theta}{cos\theta})-cosec\theta sec\theta$
$=1+tan\theta+sec\theta+cot\theta+1+\frac{1}{sin\theta}-cosec\theta-\frac{1}{cos\theta}-cosec\theta sec\theta$
$=1+tan\theta+sec\theta+cot\theta+1+cosec\theta-cosec\theta-sec\theta-cosec\theta sec\theta$
$=2+tan\theta+cot\theta-sec\theta cosec\theta$
$=2+\frac{sin\theta}{cos\theta}+\frac{cos\theta}{sin\theta}-\frac{1}{sin\theta cos\theta}$
$=\frac{2sin\theta cos\theta+sin^2\theta+cos^2\theta-1}{sin\theta cos\theta}$
$=2\frac{sin\theta cos\theta}{sin\theta cos\theta}$
$=2$

17. $\sqrt{1+tan^2\theta}\sqrt{1+cot^2\theta}\sqrt{1-cos^2\theta}\sqrt{1-sin^2\theta}=$

✗ **A.** $sec\theta$

✗ **B.** $cos\theta$

✗ **C.** $sin\theta$

✓ **D.** 1

W know that,
$sin^2\theta+cos^2\theta=1,$
$1+tan^2\theta=sec^2\theta,$
$1+cot^2\theta=cosec^2\theta$

$\sqrt{1+tan^2\theta}\times\sqrt{1+cot^2\theta}$
$\times\sqrt{1-cos^2\theta}\times\sqrt{1-sin^2\theta}$
$=\sqrt{sec^2\theta}\times\sqrt{cosec^2\theta}\times$
$\sqrt{sin^2\theta}\times\sqrt{cos^2\theta}$
$=sec\theta\times cosec\theta\times sin\theta\times cos\theta$
$=(sec\theta\times cos\theta)\times(cosec\theta\times sin\theta)$
$=1\times 1$
$=1$

18. Find the probability of getting two heads when two coins are tossed simultaneously.

✗ **A.** $\frac{1}{2}$

✗ **B.** $\frac{1}{3}$

✓ **C.** $\frac{1}{4}$

✗ **D.** 1

When two coins are tossed simultaneously, the possible outcomes are HH, HT, TH, and TT.
Favourable outcome={HH}
P(getting two heads)$= \frac{1}{4}$
Here, HH is called elementary event of the sample space {HH, HT, TH, TT}.

19. Two numbers are in the ratio of 15:11. If their H.C.F is 13, the numbers will be:

✓ **A.** 195 and 143

✗ **B.** 190 and 140

✗ **C.** 185 and 163

✗ **D.** 185 and 143

Let the required numbers be 15x and 11x.

Now, $15x = 3 \times 5 \times x$ ...(i)
$11x = 11 \times x$ ...(ii)

From (i) and (ii), we can say that x is the only common factor for both $15x$ and $11x$.
$\therefore$ x is the H.C.F. of $15x$ and $11x$.

It is given that the H.C.F of the numbers is 13.
$\therefore x = 13$

$\therefore$ The numbers are 15×13 and 11×13 i.e. 195 and 143.

20. $\frac{sin\ 42^\circ}{sec\ 48^\circ}+\frac{cos\ 42^\circ}{cosec\ 48^\circ}-\frac{4}{3}sin^2 30^\circ=$____

✗ **A.** $\frac{-2}{3}$

✓ **B.** $\frac{2}{3}$

✗ **C.** $\frac{1}{3}$

✗ **D.** 1

$\frac{sin\ 42^\circ}{sec\ 48^\circ}+\frac{cos\ 42^\circ}{cosec\ 48^\circ}-\frac{4}{3}sin^2 30^\circ=$

$=\frac{sin\ 42^\circ}{sec(90^\circ-42^\circ)}+\frac{cos\ 42^\circ}{cosec(90-42^\circ)}-\frac{4}{3}\left(\frac{1}{2}\right)^2$

$=\frac{sin\ 42^\circ}{cosec\ 42^\circ}+\frac{cos\ 42^\circ}{sec\ 42^\circ}-\frac{\cancel{4}^{1}}{3}\left(\frac{1}{\cancel{4}}\right)\quad(\because cosec(90^\circ-\theta)=sec\theta,\ sec(90^\circ-\theta)=cosec\theta)$

$=sin^2 42^\circ+cos^2 42^\circ-\frac{1}{3}$

$=1-\frac{1}{3}\quad(\because sin^2\theta+cos^2\theta=1)=\frac{2}{3}$

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21. $\triangle ABC$ is right angled at B and the perpendicular drawn from B to the opposite side AC bisects it at D. If AD = DC = 5 cm, then find the length of BD.

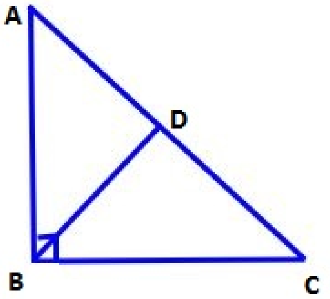
✓ **A.** 5 cm

✗ **B.** 10 cm

✗ **C.** 25 cm

✗ **D.** 12.5 cm

If a perpendicular is drawn from the vertex of the right angle to the hypotenuse, then the triangles on both sides of the perpendicular are similar to each other and to the whole triangle.



Here, $\triangle ABC$ is right angled triangle at B and BD is the perpendicular drawn to the opposite side

$\therefore\ \triangle ABD \sim \triangle BCD$

$\Rightarrow \frac{BD}{CD} = \frac{AD}{BD}$

$\Rightarrow BD^2 = AD \times DC$

$\Rightarrow BD^2 = 5 \times 5$

$\Rightarrow BD = \sqrt{25} = 5 \text{ cm}$

22. What is the probability of getting a sum of 11 when a pair of dice is rolled?

✗ **A.** 0

✓ **B.** $\frac{1}{18}$

✗ **C.** $\frac{1}{12}$

✗ **D.** $\frac{1}{11}$

Sample space for rolling a pair of dice
= S { (1,1) , (1,2) , (1,3) , (1,4), (1,5), (1,6) ,
(2,1) , (2,2) , (2,3) , (2,4) , (2,5) , (2,6) ,
(3,1) , (3,2) , (3,3) , (3,4) , (3,5) , (3,6) ,
(4,1) , (4,2) , (4,3) , (4,4) , (4,5) , (4,6) ,
(5,1) , (5,2) , (5,3) , (5,4) , (5,5) , (5,6) ,
(6,1) , (6,2) , (6,3) , (6,4) , (6,5) , (6,6) }

$\Rightarrow$ Total number of outcomes = 36

From the sample space, it is clear that the sum is 11, when there is a (5,6) and (6,5)

So, a sum of 11 happens in two cases.

Hence, the probability is $\frac{2}{36} = \frac{1}{18}$

23. The points on X-axis at a distance of 10 units from (11, –8) are ___________.

☒ **A.** (5, 0) and (16, 0)

☒ **B.** (6, 0) and (17, 0)

☑ **C.** (5, 0) and (17, 0)

☒ **D.** (5, 2) and (17, 0)

We know that y-coordinate of a point on X-axis is always 0.

Therefore, the required points can be expressed in the form (x, 0), where x is the x-coordinate.

Distance between two points (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

Distance between (11, -8) and (x, 0) = 10 units (given)

$$\Rightarrow (x - 11)^2 + 8^2 = 10^2$$
$$\Rightarrow x^2 - 22x + 121 + 64 = 100$$
$$\Rightarrow x^2 - 22x + 85 = 0$$

On factorising the above equation, we get

$$x^2 - 17x - 5x + 85 = 0$$
$$\Rightarrow (x - 17)(x - 5) = 0$$
$$\Rightarrow x = 17 \; or \; 5$$

Hence, the required points are (17, 0) and (5, 0).

24. A box contains 3 black balls, 4 red balls and 3 green balls. All the balls are identical in shape and size. Rohit takes out a ball from the bag without looking into it. What is the probability that the ball drawn is a black ball?

✓ **A.** $\frac{3}{10}$

✗ **B.** $\frac{4}{10}$

✗ **C.** $\frac{2}{5}$

✗ **D.** $\frac{1}{2}$

Given,

Number of black balls in the bag = 3

Number of red balls in the bag = 4

Number of green balls in the bag = 3

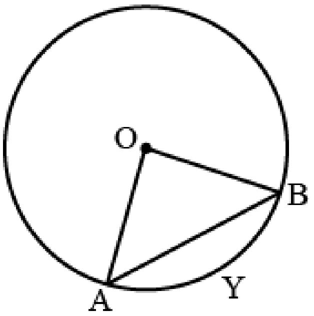
Total number of balls in the bag = 3 + 4 + 3 = 10

Number of favourable outcomes = 3

Probability of drawing a black ball, P(black ball)=$\frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$

$\Rightarrow \mathrm{P}(\text{black ball }) = \frac{3}{10}$

25. A chord AB of length 5 cm is drawn in a circle in such a way that if its endpoints A and B are joined from the centre of the circle, then it forms an equilateral △. Find the area of the sector OAYB as shown in the figure.



✗ **A.** 16.64 cm^2

✗ **B.** 14.28 cm^2

✗ **C.** 15.23 cm^2

✓ **D.** 13.09 cm^2

Given: AB = 5 cm
As, OAB is an equilateral triangle.
So, OA= OB = AB = 5 cm and $\angle$AOB = 60°
$\Rightarrow r$ = OA = 5 cm
Area of Sector OAYB = $\frac{x^\circ}{360^\circ} \times \pi \times r^2$
= $\frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 5^2$
= 13.09 cm^2

26. For what value of k is (-2) a zero of the polynomial $x^2 - x - (2k+2)$?

✗ **A.** 1

✓ **B.** 2

✗ **C.** - 1

✗ **D.** - 2

Let $f(x) = x^2 - x - (2k+2)$
Given that (-2) is a zero of the polynomial $x^2 - x - (2k+2)$.
Then, f(-2) = 0.
$\Rightarrow (-2)^2 - (-2) - (2k+2) = 0$
$\Rightarrow 4 + 2 - 2k - 2 = 0$
$\Rightarrow k = 2$

27. 3 people A, B and C are sitting in a circular fashion. Find the probability that A and B do not sit together.

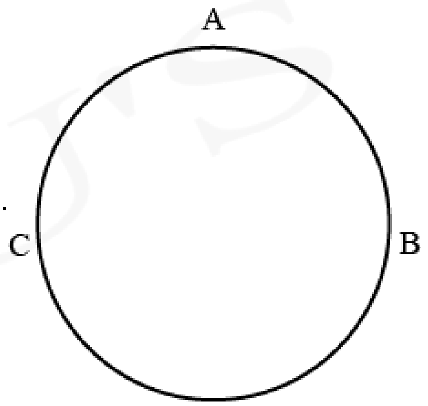
☑ **A.** 0

☒ **B.** $\frac{1}{2}$

☒ **C.** $\frac{1}{3}$

☒ **D.** 1

Let us draw the figure of their seating arrangement.



Since they are seated in circular fashion, the order does not matter and hence A, B and C will always sit next to each other.

$\therefore$ Probability that A and B will not sit next to each other will be 0.

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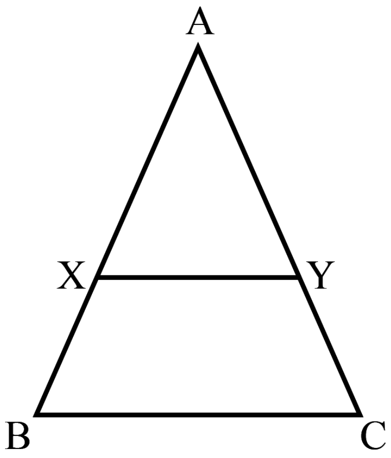
28. In the following figure, triangle AXY is isosceles with $\angle AXY = \angle AYX$.

If $\frac{BX}{AX} = \frac{CY}{AY}$, then triangle ABC is ______.



☒ **A.** scalene

☑ **B.** isosceles

☒ **C.** equilateral

☒ **D.** isosceles right angled

Here, $\frac{BX}{AX} = \frac{CY}{AY}$

$\Rightarrow \frac{AX}{BX} = \frac{AY}{CY}$
(By taking reciprocals on both sides)

$\therefore XY || BC$
(By converse of basic proportionality theorem)

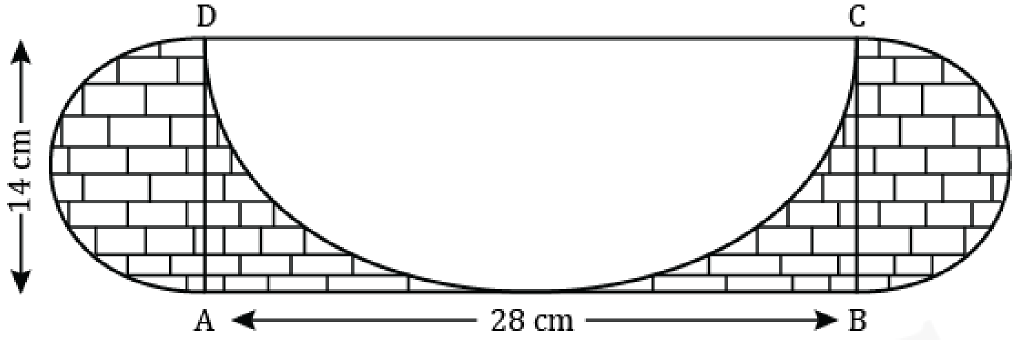
$\therefore \angle B = \angle AXY$ and $\angle C = \angle AYX$
(Corresponding angles)

But $\angle AXY = \angle AYX$ (Given)

$\Rightarrow \angle B = \angle C$
$\Rightarrow AC = AB$
(Sides opposite to equal angles are equal)

$\therefore \Delta ABC$ is an isosceles triangle.

29. ABCD is a rectangle with AB = 28 cm and BC = 14 cm. Taking DC, BC, and AD as diameters, three semicircles are drawn as shown in the figure. Find the area of shaded region. (Use $\pi = \frac{22}{7}$)



✗ **A.** 438 cm^2

✗ **B.** 338 cm^2

✗ **C.** 200 cm^2

✓ **D.** 238 cm^2

Area of rectangle ABCD = AB $\times$ BC = 28 $\times$ 14 = 392 cm^2

Area of semicircle = $\frac{1}{2}\times\frac{\pi}{4}\times D^2$

Area of semicircle of diameter CD

= $\frac{1}{2}\times\frac{\pi}{4}\times CD^2$

= $\frac{1}{2}\times\frac{\pi}{4}\times 28^2$ [Use π = $\frac{22}{7}$]

= 308 cm^2

As, AD = BC

So,

Area of semicircle of diameter BC = Area of Semicircle of diameter AD

= $\frac{1}{2}\times\frac{\pi}{4}\times AD^2$

= $\frac{1}{2}\times\frac{\pi}{4}\times 14^2$ [Use π = $\frac{22}{7}$]

= 77 cm^2

Area of shaded portion = [Area of rectangle ABCD – Area of semicircle of diameter CD) + Area of semicircle of diameter BC + Area of semicircle of diameter AD]

Area of shaded portion

= (392 – 308) +2 $\times$ 77

= 238 cm^2

30. If $sin\ A + sin^2 A = 1$, then $cos^2\ A + cos^4\ A = ?$

- ☒ **A.** 0
- ✓ **B.** 1
- ☒ **C.** 2
- ☒ **D.** 3

We have,

$sin\ A + sin^2 A = 1$
$\Rightarrow sin\ A = 1 - sin^2 A$

$\Rightarrow sin\ A = cos^2\ A - - - (i)$

Squaring both sides,

$\Rightarrow sin^2\ A = cos^4\ A - - - (ii)$

From equations (i) and (ii), we have

$cos^2\ A + cos^4\ A = sin\ A + sin^2\ A = 1$

31. Sum of two numbers is 4 more than the twice of difference of the two numbers. If one of the two numbers is three more than the other number, then find the numbers.

- ☑ **A.** $(\frac{13}{2}, \frac{7}{2})$
- ☒ **B.** (1, 3)
- ☒ **C.** $(\frac{4}{5}, 3)$
- ☒ **D.** (1, 2)

Let one number be x and other be y.

1st case:
$x + y = 4 + 2(x - y)$
$\Rightarrow x + y = 4 + 2x - 2y$
$\Rightarrow x - 3y + 4 = 0$ ...(i)

2nd case:
$x = 3 + y$ ...(ii)

On substituting (ii) in (i), we get
$(3 + y) - 3y + 4 = 0$
$\Rightarrow y = \frac{7}{2}$

On substituting the value of y in (ii), we get
$x = 3 + \frac{7}{2} = \frac{13}{2}$

Therefore, the numbers are $\frac{13}{2}$ and $\frac{7}{2}$.

32. Which of the following is a solution to $3x + 4y = 38$?

✗ **A.** (3, 4)

✓ **B.** (6, 5)

✗ **C.** (2, 19)

✗ **D.** (3, 12)

The solution of a linear equation satisfies the equation.

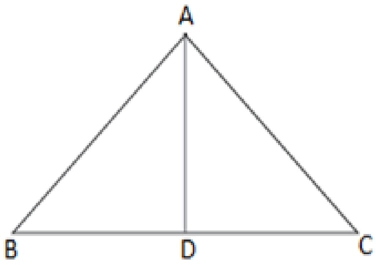
$3 \times 3 + 4 \times 4 = 9 + 16 = 25 \neq 38 \rightarrow$ (3, 4) does not satisfy the equation.

$3 \times 6 + 4 \times 5 = 18 + 20 = 38 \rightarrow$ (6, 5) satisfies the equation.

$3 \times 2 + 4 \times 19 = 6 + 76 = 82 \neq 38 \rightarrow$ (2, 19) does not satisfy the equation.

$3 \times 3 + 4 \times 12 = 9 + 48 = 57 \neq 38 \rightarrow$ (3, 12) does not satisfy the equation.

33. In ΔABC, AD is the median. Which of these conditions should be satisfied to make ΔADB and ΔADC similar triangles?



✗ **A.** $\angle A = 90^\circ$

✓ **B.** $AB = AC$

✗ **C.** $\angle B = \angle A$

✗ **D.** $BD = AD$

In the triangles ΔADB and ΔADC,

AD is the common side.

BD = DC (Since D is the midpoint of BC)

For the triangles to be similar, the ratio of corresponding sides of ΔADB and ΔADC should be equal.

$\Rightarrow \frac{AD}{AD} = \frac{BD}{DC} = \frac{AB}{AC}$

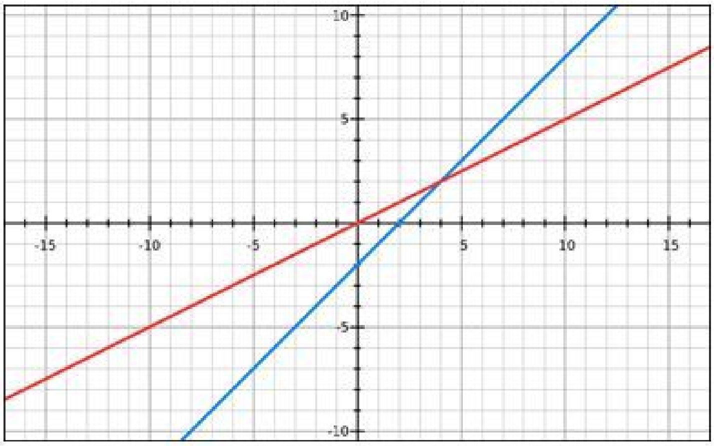
$\Rightarrow 1 = \frac{AB}{AC}$

$\Rightarrow AB = AC$

Thus, if AB = AC, then both the triangles can be proved similar.

Term 1 - Full Test

34. What is the solution of the graph given below?

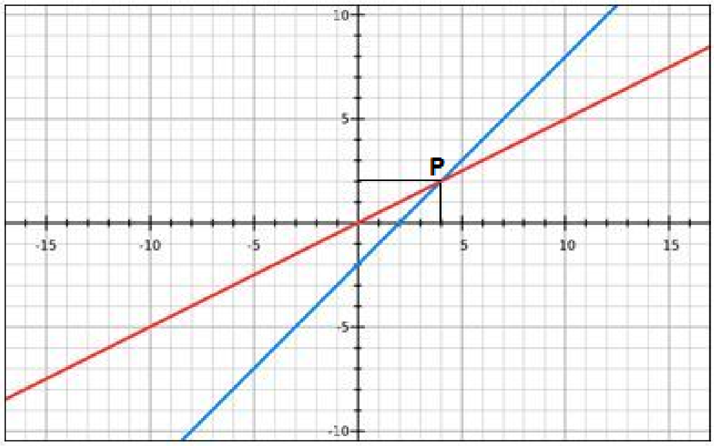


☒ **A.** $x = 0,\ y = 0$

☑ **B.** $x = 4,\ y = 2$

☒ **C.** $x = 5,\ y = 2$

☒ **D.** $x = -5,\ y = 2$



We can observe from the graph that, the two lines intersect at the point P. We know that, the point of intersection of two lines is the solution of the graph.

For the point P, the value corresponding to x-axis is 4 and the value corresponding to y-axis is 2. Hence, (4, 2) is the solution for the given graph.

35. If $3sin\theta + 4cos\theta = 5$, then the value of $sin\theta$ is _____.

✗ **A.** $\frac{2}{3}$

✗ **B.** $\frac{4}{5}$

✓ **C.** $\frac{3}{5}$

✗ **D.** $\frac{5}{3}$

$Given,\ 3sin\theta + 4cos\theta = 5.......(1)$

$Squaring\ both\ sides,\ we\ have:$

$(3sin\theta + 4cos\theta)^2 = (5)^2$

$\Rightarrow 9\sin^2\theta + 16\cos^2\theta + 24sin\theta cos\theta = 25$

$\Rightarrow 9(1 - \cos^2\theta) + 16(1 - \sin^2\theta) + 24sin\theta cos\theta = 25$

$\Rightarrow 9 - 9cos^2\theta + 16 - 16\sin^2\theta + 24sin\theta cos\theta = 25$

$\Rightarrow 16\sin^2\theta + 9cos^2\theta - 24sin\theta cos\theta = 0$

$\Rightarrow (4sin\theta - 3cos\theta)^2 = 0$

$\Rightarrow 4sin\theta - 3cos\theta = 0$
$\Rightarrow 4sin\theta = 3cos\theta$

$\Rightarrow tan\theta = \frac{3}{4}$

$sin\theta = \frac{3}{5}$

36. For what value of k, will the following pair of linear equations in two variable have infinitely many solutions?

$2x+3y=4,(k+2)x+6y=3k+2$

✓ **A.** k = 2

✗ **B.** k = 3

✗ **C.** k = 4

✗ **D.** k = 5

Given: $2x+3y=4,(k+2)x+6y=3k+2$

Condition for infinitely many solutions is

$\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$

$a_1=2,a_2=k+2,\ b_1=3,b_2=6,\ c_1=-4,\ c_2=-(3k+2)$

$\frac{2}{k+2}=\frac{3}{6}=\frac{-4}{-(3k+2)}$

$\frac{2}{k+2}=\frac{3}{6}$

$\frac{2}{k+2}=\frac{1}{2}$

$k+2=4$

$k=2$

37. What is the probability of not picking a face card when you draw a card at random from a pack of 52 cards?

✗ **A.** $\frac{1}{13}$

✗ **B.** $\frac{4}{13}$

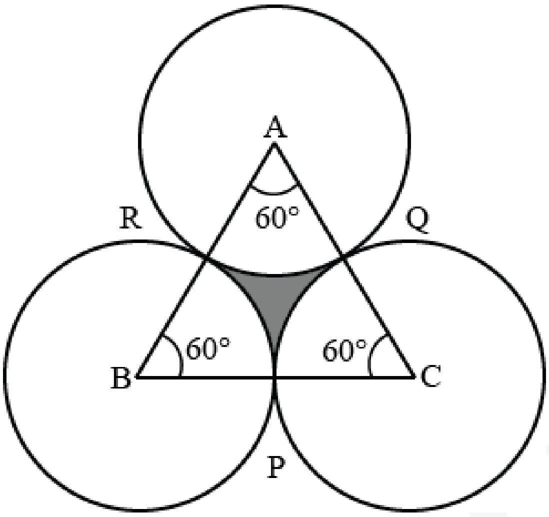
✓ **C.** $\frac{10}{13}$

✗ **D.** $\frac{12}{13}$

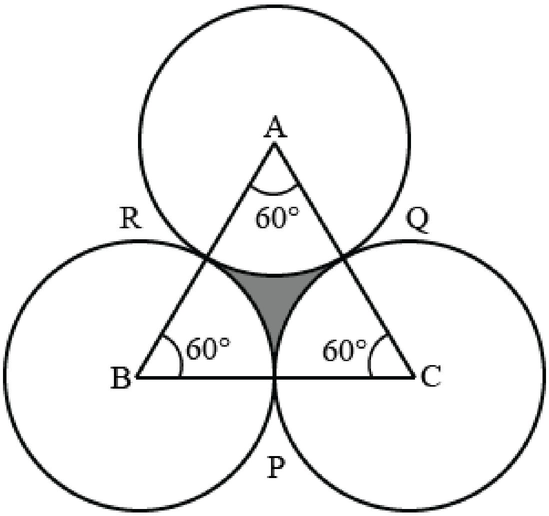
Since there are 12 face cards in a deck of 52cards, the probability of drawing a face card is $\frac{12}{52}=\frac{3}{13}$

Hence, the probability of not picking a face card = $1-\frac{3}{13}=\frac{10}{13}$

38. The area of an equilateral ΔABC is 17320.5 cm^2. A circle is drawn taking the vertex of the triangle as centre. The radius of the circle is half the length of the side of triangle. Find the area of the shaded region (in cm^2) . (π = 3.14 , $\sqrt{3}$ =1.73205)



- ✗ **A.** 1320.5 cm^2
- ✗ **B.** 1650.0 cm^2
- ✓ **C.** 1620.5 cm^2
- ✗ **D.** 1220.5 cm^2



Area of shaded region = area of ΔABC - 3 (Area of sector BPR)

Let 'a' be the side of the equilateral ΔABC.

Using area of an equilateral triangle = $\frac{\sqrt{3}}{4}a^2$,
$\frac{\sqrt{3}}{4}a^2$ = 17320.5

Solving, $a^2 = \frac{17320.5 \times 4}{\sqrt{3}}$

$\implies a^2 = \frac{17320.5 \times 4}{1.73205}$

$\implies a^2 = \frac{17320.5 \times 4}{17320.5 \times 10^{-4}}$

$\implies a = 2 \times 10^2$

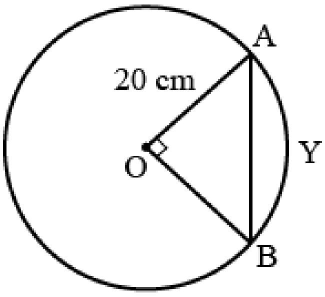
$\implies a = 200\ cm.$

Radius of the circles = $\frac{1}{2} \times 200 = 100\ cm$

Now, using area of a sector when the degree measure of the angle at the centre is θ = $\frac{\theta}{360^\circ}\pi r^2$
∴ Required area
$= 17320.5 - 3[\frac{60^\circ}{360^\circ} \times 3.14 \times 100^2]$

∴ Required area = 1620.5 cm^2

39. In a circle of radius 20 cm, a chord subtends a right angle at the centre. Find the area of the major segment: (use π = $\frac{22}{7}$)



✗ **A.** 2635.6 cm^2

✗ **B.** 1391.9 cm^2

✗ **C.** 1125.2 cm^2

✓ **D.** 1142.85 cm^2

Area of minor segment (i.e. AYB) = Area of sector OAYB – Area of $\triangle$OAB

Area of sector OAYB = $\frac{x}{360^\circ} \times \frac{22}{7} \times r^2$

Since the angle subtended by the sector at the centre = 90° and radius = 20 cm

So,

Area of sector OAYB = $\frac{90^\circ}{360^\circ} \times \frac{22}{7} \times 20^2$ = 314.28 cm^2

Area of $\triangle$ OAB = $\frac{1}{2} \times OA \times OB$

= $\frac{1}{2} \times 20 \times 20$

= $200 cm^2$

Area of minor segment (i.e. AYB) = 314.28 – 200 = 114.28 cm^2

Area of circle = $\frac{22}{7} \times r^2$

= $\frac{22}{7} \times 20^2$

= 1257.14 cm^2

Area of major segment = [Area of circle - Area of minor Segment (AYB)]

= 1257.14 - 114.28

= 1142.85 cm^2

$\therefore$ Area of major segment = 1142.85 cm^2

40. If (2,2) lies on $4x + 5y = k$, the value of k = ______.

✗ **A.** 14

✗ **B.** 16

✗ **C.** 17

✓ **D.** 18

If the point (2,2) lies on the given linear equation, then it must satisfy the equation.

Putting the value of x and y in the equation we get:

$\Rightarrow 4(2) + 5(2) = k$

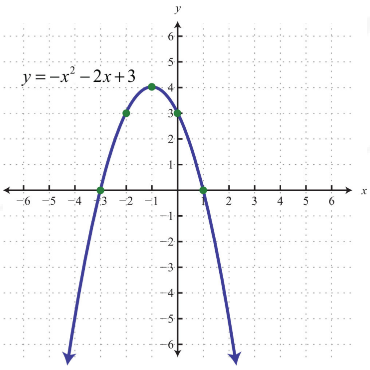
$\Rightarrow k = 18$

Thus, the value of k is 18.

41.

The above picture are few natural examples of parabolic shape which is represented by a quadratic polynomial. A parabolic arch is an arch in the shape of a parabola. In structures, their curve represents an efficient method of load, and so can be found in bridges and in architecture in a variety of forms.

Based on the above information, answer the following questions.



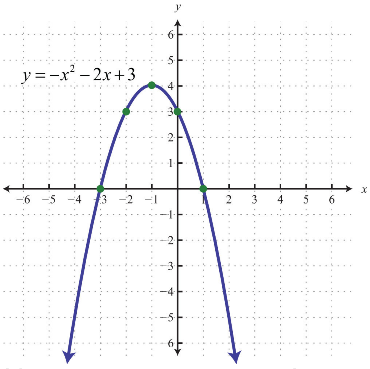
In the above graph, how many zeroes are there for the polynomial x^2-2x+3?

☒ **A.** 0

☒ **B.** 1

☑ **C.** 2

☒ **D.** 3



Here, we can clearly observe that, the graph of the polynomial x^2-2x+3 cuts the x axis at two distinct points.
Hence the number of zeroes for the given polnomial is 2.

Term 1 - Full Test

42.

The above picture are few natural examples of parabolic shape which is represented by a quadratic polynomial. A parabolic arch is an arch in the shape of a parabola. In structures, their curve represents an efficient method of load, and so can be found in bridges and in architecture in a variety of forms.

Based on the above information, answer the following questions.

If α, β are the zeroes of the polynomial $x^2 - px + 36$ and α^2+β^2 = 9, then what is the value of p?

☒ **A.** ±6

☒ **B.** ±7

☒ **C.** ±8

☑ **D.** ±9

Given polynomial $x^2 - px + 36$

On comparing with the standard form of a quadratic polynomial $ax^2 + bx + c$, we get
a = 1, b = -p, c = 36

Here, α and β are the zeroes of the polynomial.
$\Rightarrow \alpha + \beta = \frac{-b}{a} = p$
and $\alpha\beta = \frac{c}{a} = 36$

Now, α^2+$\beta^2 = (\alpha + \beta)^2$ - 2$\alpha\beta$

$\Rightarrow 9 = p^2 - 2 \times 36$ [$\because \alpha^2 + \beta^2$ = 9]
$\Rightarrow 81 = p^2$

$\Rightarrow p = 9 \text{ or } -9$

43.

The above picture are few natural examples of parabolic shape which is represented by a quadratic polynomial. A parabolic arch is an arch in the shape of a parabola. In structures, their curve represents an efficient method of load, and so can be found in bridges and in architecture in a variety of forms.

Based on the above information, answer the following questions.

The product of zeroes of a cubic polynomial $x^3 - 3x^2 - x + 5$ is ________.

✗ **A.** 5

✓ **B.** -5

✗ **C.** 3

✗ **D.** -3

If α, β and γ are the the zeroes of a cubic polynomial $ax^3 + bx^2 + cx + d$,
then
$\alpha\beta\gamma = \frac{-d}{a}$
Given polynomial: $x^3 - 3x^2 - x + 5$
Here, $a = 1, b = -3, c = -1, d = 5$
$\therefore$ Product of zeroes is $\frac{-d}{a} = \frac{-5}{1} = -5.$

44.

The above picture are few natural examples of parabolic shape which is represented by a quadratic polynomial. A parabolic arch is an arch in the shape of a parabola. In structures, their curve represents an efficient method of load, and so can be found in bridges and in architecture in a variety of forms.

Based on the above information, answer the following questions.

Find a quadratic polynomial with $\frac{1}{8}$ as the sum and 2 as product of its zeroes.

☒ **A.** $8x^2 + x + 16$

☑ **B.** $8x^2 - x + 16$

☒ **C.** $8x^2 - x - 16$

☒ **D.** $8x^2 + x - 16$

Let, α & β be zeroes.
Given, $\alpha + \beta = \frac{1}{8}; \ \alpha\beta = 2$
Therefore required polynomial is $p(x) = k[x^2 - (\alpha + \beta)x + \alpha\beta]$ where k is a real number.

Now, consider $p(x) = k[x^2 - \frac{1}{8}x + 2]$

$p(x) = k[\frac{8x^2 - x + 16}{8}]$

$p(x) = k \times \frac{1}{8}[8x^2 - x + 16]$

Let's take k = 8

(Note: multiplying a polynomial with a non-zero constant doesn't change the zeroes of the polynomial).

$\Rightarrow p(x) = 8x^2 - x + 16$

Therefore, $(8x^2 - x + 16)$ is a polynomial with $\frac{1}{8}$ as the sum and 2 as product of its zeroes.

45.

The above picture are few natural examples of parabolic shape which is represented by a quadratic polynomial. A parabolic arch is an arch in the shape of a parabola. In structures, their curve represents an efficient method of load, and so can be found in bridges and in architecture in a variety of forms.

Based on the above information, answer the following questions.

If α and β are the zeros of polynomial $x^2 + 3x - 2$, find $\frac{1}{(\alpha)^3} + \frac{1}{(\beta)^3}$.

✗ **A.** $\frac{8}{45}$

✗ **B.** $\frac{-8}{45}$

✓ **C.** $\frac{45}{8}$

✗ **D.** $\frac{45}{8}$

Given polynomial is :
$x^2 + 3x - 2$

$\Rightarrow \alpha + \beta = \frac{-b}{a} = \frac{-3}{1} = -3$

$\Rightarrow \alpha\beta = \frac{c}{a} = \frac{-2}{1} = -2$

$\therefore \frac{1}{(\alpha)^3} + \frac{1}{(\beta)^3}$

$= \frac{(\alpha)^3 + (\beta)^3}{(\alpha\beta)^3}$

$= \frac{(\alpha+\beta)^3 - 3\alpha\beta(\alpha+\beta)}{(\alpha\beta)^3}$

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

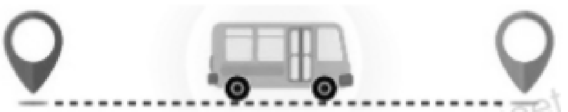
[Substituting the values of $\alpha + \beta, \alpha\beta$]

$= \frac{-27-18}{-8}$

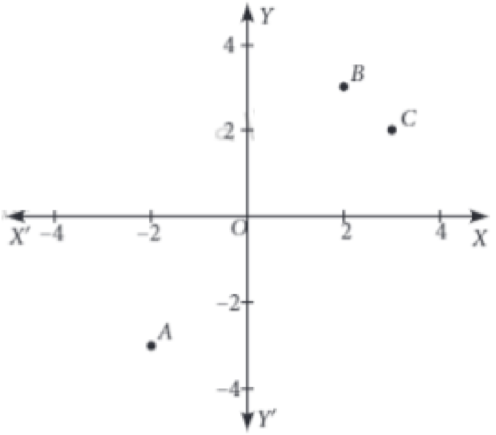
$= \frac{45}{8}$

Term 1 - Full Test

46. There are two routes to travel from the place A to B by bus. The first bus reaches the place B via C and the second bus reaches the place B from A directly. The position of A, B and C are represented in the following graph.



Scale : x-axis : 1 unit = 1 km
y-axis : 1 unit = 1 km



Based on the above information, answer the following questions.

From the given graph, find the coordinates of the place C.

✗ **A.** (2, 3)

✓ **B.** (3, 2)

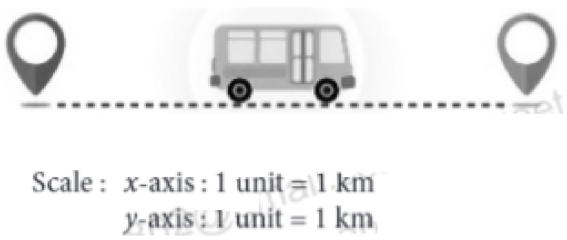
✗ **C.** (-2, -3)

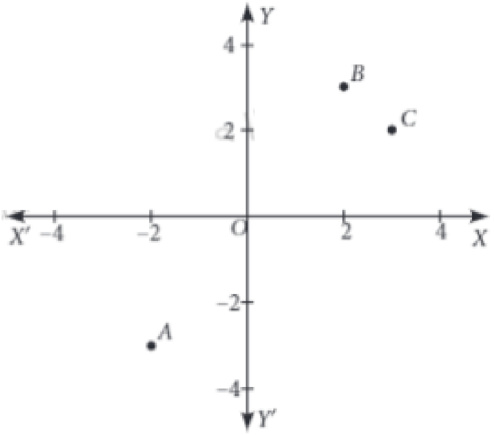
✗ **D.** (-3, -2)

From the graph, it is clear that, the point C lies on the first quadrant. Hence, both the x and y coordinates will have positive sign.

Also, we can see that, the point C lies 3 units away from Y axis and 2 units above the x axis. Hence the coordinates are (3, 2).

47. There are two routes to travel from the place A to B by bus. The first bus reaches the place B via C and the second bus reaches the place B from A directly. The position of A, B and C are represented in the following graph.





Based on the above information, answer the following questions.

The distance between A and B is ______.

☒ **A.** 13 km

☒ **B.** 26 km

☒ **C.** $\sqrt{13}$ km

☑ **D.** $2\sqrt{13}$ km

The coordinates of A, B and C are (-2, -3), (2, 3) and (3, 2).

By Distance formula, $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

On substituiting the values,

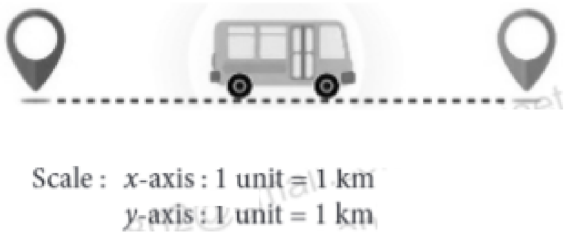
$AB = \sqrt{(2+2)^2 + (3+3)^2}$

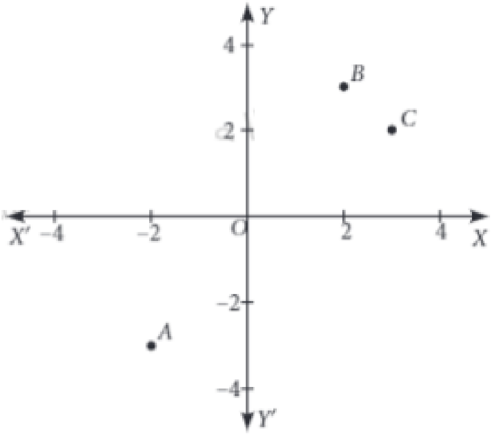
$\Rightarrow AB = \sqrt{4^2 + 6^2}$

$\Rightarrow AB = \sqrt{16 + 36}$

$\Rightarrow AB = 2\sqrt{13}\ km$

48. There are two routes to travel from the place A to B by bus. The first bus reaches the place B via C and the second bus reaches the place B from A directly. The position of A, B and C are represented in the following graph.





Based on the above information, answer the following questions.

Suppose if C is the place on the y-axis which is equidistant from the places A(-5,-2) and B(3, 2), then CA = ___ km.

✓ **A.** 5

✗ **B.** 4

✗ **C.** 3

✗ **D.** 2

Given, A(-5, -2), B(3, 2).

Let, the coordinates of C be (0, y)

We have,

CA = CB

$\Rightarrow CA^2 = CB^2$

$\Rightarrow (-5-0)^2 + (-2-y)^2 = (3-0)^2 + (2-y)^2$

$\Rightarrow 25 + 4 + y^2 + 4y = 9 + 4 + y^2 - 4y$

$\Rightarrow 8y = -16$

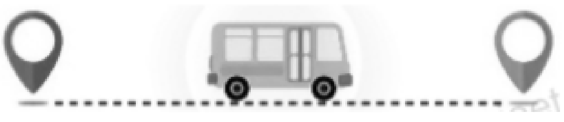
$\Rightarrow y = -2$

Therefore coordinates of C is (0, -2)

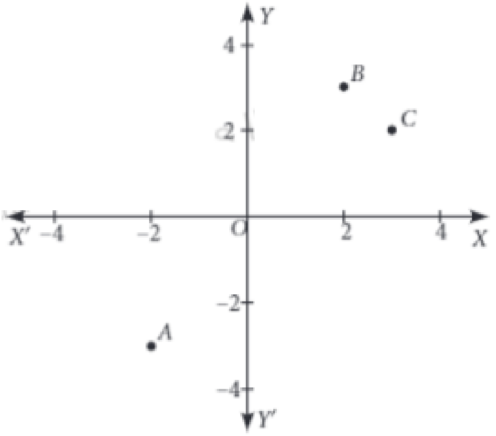
By distance formula,

$$\begin{aligned} \text{CA} &= \sqrt{(-5-0)^2 + (-2+2)^2} \\ &= \sqrt{25} \\ &= 5\ km \end{aligned}$$

49. There are two routes to travel from the place A to B by bus. The first bus reaches the place B via C and the second bus reaches the place B from A directly. The position of A, B and C are represented in the following graph.



Scale : x-axis : 1 unit = 1 km
y-axis : 1 unit = 1 km



Based on the above information, answer the following questions.

If the fare for second bus is Rs. 15 per km, then what will be the fare to reach the destination by bus? (Assume $\sqrt{13} = 3.6$)

✗ **A.** Rs. 105

✓ **B.** Rs. 108

✗ **C.** Rs. 110

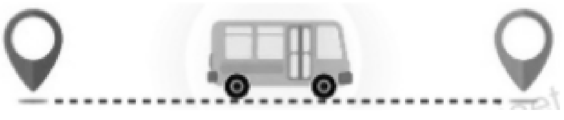
✗ **D.** Rs. 115

The coordinates of A, B and C are (-2, -3), (2, 3) and (3, 2).

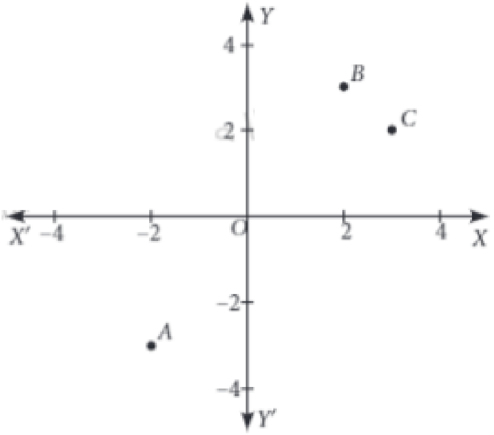
By Distance formula, $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
On substituiting the values,
$AB = \sqrt{(2+2)^2 + (3+3)^2}$
$\Rightarrow AB = \sqrt{4^2 + 6^2}$
$\Rightarrow AB = \sqrt{16 + 36}$
$\Rightarrow AB = 2\sqrt{13}\ km$

Hence, AB = 7.2 km.
Total fare $= 7.2 \times 15 = Rs108$

50. There are two routes to travel from the place A to B by bus. The first bus reaches the place B via C and the second bus reaches the place B from A directly. The position of A, B and C are represented in the following graph.



Scale : x-axis : 1 unit = 1 km
y-axis : 1 unit = 1 km



Based on the above information, answer the following questions.

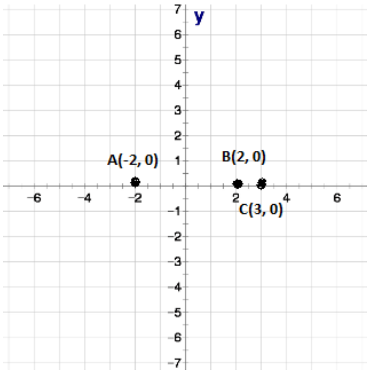
If the places A, B and C lies on the x axis such that the coordinates are (-2, 0), (2, 0) and (3,0) respectively, then find the distance between the points A and C.

✗ **A.** 2 km

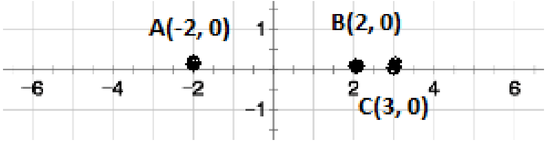
✗ **B.** 3 km

✗ **C.** 4 km

✓ **D.** 5 km



Since all the points lie on x axis, let us consider the x axis as a number line.



Hence the distance between A and C will be the sum of the distances between A and 0, 0 and B and B and C.
Distance between A and 0 is |-2| = 2 km
Distance between 0 and B is |2| = 2 km
Distance between B and C is |1| = 1 km

Total distance is 5 km.