**General Instructions:**

(i) All questions are compulsory.
(ii) The question paper consists of 34 questions divided into four sections A, B, C and D.
(iii) Sections A contains 8 questions of one mark each, which are multiple choice type questions, section B contains 6 questions of two marks each, section C contains 10 questions of three marks each, and section D
(iv) Use of calculations is not permitted.

**Q1**

The common difference of the AP $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}, \ldots \ldots$ can be found out by finding the difference between the second term and first term i.e. $\frac{1-p}{p} - \frac{1}{p} = \frac{1-p-1}{p} = \frac{-p}{p} = -1$

The correct answer is -1 which is given by option C.

**Q2**

Since, AP $\perp$ PB, CA $\perp$ AP, CB $\perp$ BP and AC = CB = radius of the circle, therefore APBC is a square having side equal to 4 cm.

Therefore, length of each tangent is 4 cm.

The correct answer is 4 cm which is given by option B.

**Q3**

Given that AB, BC, CD and AD are tangents to the circle with centre O at Q,P,S and R respectively. AB = 29 cm, AD = 23, DS = 5 cm and $\angle B = 90^0$.

Join PQ.

We know that, the lengths of the tangents drawn from an external point to a circle are equal.

$\therefore$ AR = AD – DR = 23 cm – 5 cm = 18 cm
AQ = AR = 18 cm

∴ QB = AB – AQ = 29 cm – 18 cm = 11 cm

QB = BP = 11 cm

In right ∆PQB, PQ^2 = QB^2 + BP^2 = (11 cm)^2 + (11 cm)^2 = 2 \times (11 cm)^2

PQ = 11\sqrt{2} \text{ cm} \ldots (1)

In right ∆PQB,

PQ^2 = OQ^2 + OP^2 + r^2 + r^2 = 2r^2

PQ = \sqrt{2r} \ldots (2)

From (1) and (2), we get

r = 11 cm

thus, the radius of the circle is 11 cm.

The correct answer is 11 which is given by option A.

**Q4**

Let AB be the tower of height 75 m.

∠CBD = ∠ACB = 30°

Suppose C be the position of the car from the base of the tower.

In right ∆ABC,

Cot 30° = \frac{AC}{AB}

⇒ AC = AB \cot 30°

⇒ AC = 75 m \times \sqrt{3}

⇒ AC = 75\sqrt{3} \text{ m}
Thus, the distance of the car from the base of the tower is \(75 \sqrt{3}\) m.

The correct answer is \(75\sqrt{3}\) which is given by option C.

**Q5**

When a die is thrown once, the sample space is given by, \(S = \{1, 2, 3, 4, 5, \text{ and } 6\}\)

Then, the event, \(E\) of getting an even number is given by, \(E = \{2, 4, \text{ and } 6\}\)

\[
\therefore \text{Probability of getting an even number} = P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of all possible outcomes}} = \frac{3}{6} = \frac{1}{2}
\]

The correct answer is \(\frac{1}{2}\) which is given by option A.

**Q6**

If the given that the box contains 90 discs, numbered from 1 to 90.

As one disc is drawn at random from the box, the sample space is given by, \(S = \{1, 2, 3, \ldots 90\}\)

The prime number less than 23 are 2, 3, 5, 7, 11, 13, 17, and 19.

Then, the event, \(E\) of getting a prime number is given by, \(E = \{2, 3, 5, 7, 11, 13, 17, 19\}\)

\[
\therefore P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of all possible outcomes}} = \frac{8}{90} = \frac{4}{45}
\]

The correct answer is \(\frac{4}{45}\) which is given by option C.

**Q7**
Construction: Draw AM ⊥ BC.

It can be observed from the given figure that BC = 5 unit and AM = 3 unit.

It \( \triangle ABC \), BC is the base and AM is the height.

Area of triangle ABC = \( \frac{1}{2} \times \text{base} \times \text{height} \)

= \( \frac{1}{2} \times BC \times AM \)

= \( \frac{1}{2} \times 5 \times 3 \) sq.units

= 7.5 sq.units

The correct answer is 7.5 which is given by option C.

Q8

Difference between circumference and radius of the circle = 37 cm

Let \( r \) be the radius of the circle.

\[ 2\pi r - r = 37 \text{ cm} \]
\[ r \left(2\pi - 1\right) = 37 \text{ cm} \]
\[ r \left(2 \times \frac{22}{7} - 1\right) = 37 \text{ cm} \]
\[ r \times \frac{37}{7} = 37 \text{ cm} \]
\[ r = 7 \text{ cm} \]

\[ \therefore \text{Circumference of the circle} = 2\pi r = 2 \times \frac{22}{7} \times 7 \text{ cm} = 44 \text{ cm} \]

The correct answer is 44 which is given by option B.

**Q9**

\[ 4\sqrt{3}x^2 + 5x - 2\sqrt{3} = 0 \]

\[ \Rightarrow 4\sqrt{3} x^2 + 8x - 3x - 2\sqrt{3} = 0 \]

\[ \Rightarrow 4x(\sqrt{3}x + 2) - \sqrt{3}(\sqrt{3} + 2) = 0 \]

\[ \Rightarrow (4x - \sqrt{3})(\sqrt{3}x + 2) = 0 \]

\[ \therefore x = \frac{\sqrt{3}}{4} \text{ or } x = -\frac{2}{\sqrt{3}} \]

**Q10**

All the three-digit natural numbers that are divisible by 7 will be of the form 7n.

Therefore, 100 ≤ 7n ≤ 999 => \[14 \frac{2}{7} ≤ n ≤ 142\frac{5}{7}\]

Since, n is an integer, therefore, there will be 142 – 14 = 128 three-digit natural numbers that will be divisible by 7.

Therefore, there will be 128 three – digit natural numbers that will be divisible by 7.

**Q11**

Given that \(AB = 12\) cm, \(BC = 8\) cm and \(AC = 10\) cm.

Let, \(AD = AF = p\) cm, \(BD = BE = q\) cm and \(CE = CF = r\) cm

(Tangents drawn from an external point to the circle are equal in length)

\[ 2(p + q + r) = AB + BC + AC = AD + DB + BE + EC + AF + FC = 30 \text{ cm} \]

\[ p + q + r = 15 \]

\[ AB = AD + DB = p + q = 12 \text{ cm} \]

Therefore, \(r = CF = 15 - 12 = 3 \text{ cm} \).
AC = AF + FC = p + r = 10 cm

Therefore, q = BE = 15 − 10 = 5 cm.

Therefore, p = AD = p + q + r − r − q = 15 − 3 − 5 = 7 cm.

Q12.

**GIVEN:** ABCD be a parallelogram circumscribing a circle with centre O.

**TO PROVE:** ABCD is a rhombus.

We know that the tangents drawn to a circle from an exterior point are equal in length.

Therefore, AP = AS, BP = BQ, CR = CQ and DR = DS.

\[ AP + BP + CR + DR = AS + BQ + CQ + DS \]

\[ (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ) \]

Therefore, \( AB + CD = AD + BC \) or \( 2AB = 2BC \) (Since, AB = DC and AD = BC)

Therefore, \( AB = BC = DC = AD. \)

Therefore, ABCD is a rhombus.

**Hence, proved.**
Q13

Let E denote the event that the drawn card is neither a king nor a queen.

Total number of possible cases = 52.

Total number of cards that are king and those that are queen in the pack of playing cards = 4 + 4 = 8.

Therefore, there are 52-8 = 44 cards that are neither a king nor a queen.

Total number of favorable cases = 44.

\[ \therefore \text{Required probability} = P(E) = \frac{\text{Favourable number of cases}}{\text{Total number of cases}} = \frac{44}{52} = \frac{11}{13} \]

Thus, the probability that the drawn card is neither a king nor a queen is \(\frac{11}{13}\).

Q14

Dimension of the rectangular card board = 14 cm x 7 cm

Since, two circular pieces of equal radii and maximum area touching each other are cut from the rectangular card board, therefore, the diameter of each of each circular piece is \(\frac{14}{2} = 7\) cm.

Radius of each circular piece = \(\frac{7}{2}\) cm.

\[ \therefore \text{Sum of area of two circular pieces} = 2 \times \pi \left(\frac{7}{2}\right)^2 = 2 \times \frac{22}{7} \times \frac{49}{4} = 77 \text{ cm}^2 \]

Area of the remaining card board = Area of the card board – Area of two circular pieces

= 14 cm x 7 cm – 77 cm\(^2\) = 98 cm\(^2\) – 77 cm\(^2\) = 21 cm\(^2\)

Thus, the area of the remaining card board is 21 cm\(^2\).

Q15

The given quadratic equation is \(k \times (x - 2) + 6 = 0\).

This equation can be rewritten as \(kx^2 - 2kx + 6 = 0\).
For equal roots, it discriminate, \( D = 0 \).

\[
\Rightarrow b^2 - 4ac = 0, \text{ where } a = k, b = -2k \text{ and } c = 6
\]

\[
\Rightarrow 4k^2 - 24k = 0
\]

\[
\Rightarrow 4k(k - 6) = 0
\]

\[
\Rightarrow k = 0 \text{ or } k = 6
\]

But \( k \) cannot be 0, so the value of \( k \) is 6.

**Q16**

The AP is given as 18, 15\(\frac{1}{2}\), 13, ..., -49\(\frac{1}{2}\).

First term \( a = 18 \), common difference \( d = 15\frac{1}{2} - 18 = -2\frac{1}{2} \) and the last term of the AP = -49\(\frac{1}{2}\).

Let the AP has \( n \) terms.

\[
a_n = a + (n-1)d
\]

\[
-(99/2) = 18 - (5/2)(n-1)
\]

\[
5(n-1) = 135
\]

\[
n = 27 + 1
\]

\[
n = 28
\]

\[
\therefore n = 27 + 1 = 28
\]

Thus, the given AP has 28 terms.

**Now**, the sum of all the terms \( (S_n) \) is given by,

\[
S_n = \frac{n}{2} [2a + (n-1)d] = \frac{29}{2} [2 \times 18 + (28 - 1) \times (-\frac{5}{2})] = 14 [36 - 27 \times \frac{5}{2}] = -441
\]

Thus, the sum of all the terms of the AP is \(-441\).

**Q17**
Step 1

Draw a line segment AB = 4 cm. Taking point A as centre, draw an arc of 5 cm radius. Similarly, taking point B as its centre, draw an arc of 6 cm radius. These arcs will intersect each other at point C. Now, AC = 5 cm and BC = 6 cm and \( \triangle ABC \) is the required triangle.

Step 2

Draw a ray AX making an acute angle with line AB on the opposite side of vertex C.

Step 3

Locate 3 points \( A_1, A_2, A_3 \) (as 3 is greater between 2 and 3) on line AX such that \( AA_1 = A_1A_2 = A_2A_3 \).

Step 4

Join \( BA_3 \) and draw a line through \( A_2 \) parallel to \( BA_3 \) to intersect \( AB \) at point \( B' \).

Step 5

Draw a line through \( B' \) parallel to the line \( BC \) to intersect \( AC \) at \( C' \). \( \triangle AB'C' \) is the required triangle.
Let AB and CD be two poles, where CD = 24 m.

It is given that angle of depression of the top of the pole AB as seen from the top of the pole CD is 30° and horizontal distance between the two poles is 15 m.

∴ ∠CAL = 30° and BD = 15 m.

To find: height of pole AB

Let the height of pole AB be h m.

AL = BD = 15 m and AB = LD = h

Therefore, CL = CD – LD = 24 – h

Consider right triangle ACL:

\[
\tan 30^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{CL}{AL}
\]

\[
\Rightarrow \tan 30^\circ = \frac{24-h}{15}
\]

\[
\Rightarrow \frac{1}{\sqrt{3}} = \frac{24-h}{15}
\]

\[
\Rightarrow 24 - h = \frac{15}{\sqrt{3}}
\]

\[
\Rightarrow 24 - h = 5\sqrt{3}
\]

\[
\Rightarrow h = 24 - 5\sqrt{3}
\]

\[
\Rightarrow h = 24 - 5 \times 1.732 \quad \text{[Taking } \sqrt{3} = 1.732]\]

\[
\Rightarrow h = 15.34
\]

Therefore, height of the pole AB = h m = **15.34 m**.

Q19
Let the given points be A (7,10) B(-2,5) and C(3,-4).

Using distance formula, we have

\[ AB = \sqrt{(7 + 2)^2 + (10 - 5)^2} = \sqrt{81 + 25} = \sqrt{106} \]

\[ BC = \sqrt{(-2 - 3)^2 + (5 + 4)^2} = \sqrt{25 + 81} = \sqrt{106} \]

\[ CA = \sqrt{(7 - 3)^2 + (10 + 4)^2} = \sqrt{16 + 196} = \sqrt{212} \]

Since \( AB = BC \), therefore, \( \triangle ABC \) is an isosceles triangle.

Also, \( AB^2 + BC^2 = 106 + 106 = 212 = AC^2 \)

So, \( \triangle ABC \) is a right triangle right angled at \( \angle B \).

So, \( \triangle ABC \) is an isosceles triangle as well as a right triangle.

Thus, the points (7, 10), (-2, 5) and (3,-4) are the vertices of an isosceles right triangle.

Q20

Let the y-axis divide the line segment joining the points (-4,-6) and (10,12) in the ratio \( \lambda :1 \) and the Point of the intersection be (0,y).

So, by section formula, we have:

\[
\left( \frac{10 \overline{\lambda} - 4}{\overline{\lambda} + 1}, \frac{12 \overline{\lambda} + (-6)}{\overline{\lambda} + 1} \right) = (0,y)
\]

\[
\therefore \; \frac{10 \overline{\lambda} - 4}{\overline{\lambda} + 1} = 0 \Rightarrow 10 \overline{\lambda} - 4 = 0
\]

\[
\Rightarrow \; \overline{\lambda} = \frac{4}{10} = \frac{2}{5}
\]

Therefore, \( y = \frac{12 \overline{\lambda} + (-6)}{\overline{\lambda} + 1} = \frac{12 \times \frac{2}{5} - 6}{\frac{2}{5} + 1} = \frac{24 - 30}{\frac{2}{5}} = -\frac{6}{7} \)

Thus, the y-axis divides the line segment joining the given points in the ratio 2 : 5 and the point of division is \( (0, -\frac{6}{7}) \).
Q21

AB and CD are the diameters of a circle with centre O.

Therefore, OA = OB = OC = OD = 7 cm (Radius of the circle)

Area of the shaded region

\[ \text{Area} = \text{Area of the circle with diameter OB} + \text{(Area of the semi-circle ACDA} - \text{Area of } \triangle ACD) \]

\[ = \pi \left(\frac{7}{2}\right)^2 + \left(\frac{1}{2} \pi \times (7)^2 - \frac{1}{2} \times 14 \times 7 \right) \]

\[ = \frac{22}{7} \times \frac{49}{4} \text{ cm}^2 + \frac{1}{2} \times \frac{22}{7} \times 49 \text{ cm}^2 - \frac{1}{2} \times 14 \times 7 \text{ cm} \]

\[ = \frac{77}{2} \text{ cm}^2 + 77 \text{ cm}^2 - 49 \text{ cm}^2 \]

\[ = 66.5 \text{ cm}^2 \]

Thus, the area of the shaded region is 66.5 cm².

Q22

Let the radius and height of cylinder is \( r \) cm and \( h \) cm respectively.

Diameter of the hemisphere bowl = 14 cm

\[ \therefore \text{Radius of the hemispherical bowl} = \text{Radius of the cylinder} = r = \frac{14}{2} \text{ cm} = 7 \text{ cm} \]

Total height of the vessel = 13 cm

\[ \therefore \text{Height of the cylinder, } h = \text{Total height of the vessel} - \text{Radius of the hemispherical bowl} \]

\[ = 13 \text{ cm} - 7 \text{ cm} = 6 \text{ cm} \]
Total surface area of the vessel = 2 (curved surface area of the cylinder + curved surface area of the hemisphere) (Twice because the vessel is hollow)

= 2(2\pi rh + 2\pi r^2) = 4\pi r(h+r) = 4 \times \frac{22}{7} \times 7 \times (6+7) cm^2

= 1144 cm^2

Thus, the total surface area of the vessel is 1144 cm^2.

Q23

Height of the cylinder, h = 10 cm
Radius of the cylinder = Radius of each hemisphere = r = 3.5 cm
Volume of wood in the toy = Volume of the cylinder – 2 x Volume of each hemisphere

= \pi r^2 h - 2 \times \frac{2}{3} \pi r^3

= \frac{22}{7} \times (3.5 cm)^2 \times 10 cm - \frac{4}{3} \times \frac{22}{7} \times (3.5 cm)^3

= 385 cm^3 - \frac{539}{3} cm^3

= \frac{616}{3} cm^3

= 205.33 cm^3 (Approx)

Thus, the volume of the wood in the toy is approximately 205.33 cm^3.

Q24

It is given that, radius = 21 cm.

The Arc subtends an angle of 60°.
(i) Length \( l \) of the arc is given by: 
\[ l = \frac{\theta}{360^0} \times 2\pi r \], where \( r = 21 \text{ cm} \) and \( \theta = 60^0 \)

\[ l = \frac{60}{360} \times 2 \times \frac{22}{7} \times 21 \text{ cm} \]

\[ = 22 \text{ cm} \]

(ii) Area, \( A \) of the sector formed by the arc is given by

\[ A = \frac{\theta}{360^0} \times \pi r^2 \], where \( r = 21 \text{ cm} \) and \( \theta = 60^0 \)

\[ A = \frac{60}{360} \times \frac{22}{7} \times 21 \times 21 \text{ cm}^2 \]

\[ = 231 \text{ cm}^2 \]

Q25

The given equation is \( \frac{1}{2a+b+2x} = \frac{1}{2a} + \frac{1}{b} + \frac{1}{2x} \)

\[
\Rightarrow \frac{1}{2a+b+2x} - \frac{1}{2x} = \frac{1}{2a} + \frac{1}{b} \\
\Rightarrow \frac{2x-2a-b-2x}{2x(2a+b+2x)} = \frac{b+2a}{2ab} \\
\Rightarrow \frac{-(2a+b)}{2x(2a+b+2x)} = \frac{b+2a}{2ab} \\
\Rightarrow \frac{1}{x(2a+b+2x)} = \frac{1}{ab} \\
\Rightarrow 2x^2 + 2ax + bx + ab = 0 \\
\Rightarrow 2x(x+a) + b(x+a) = 0 \\
\Rightarrow (x+a)(2x+b) = 0 \\
\Rightarrow x+a = 0 \text{ or } 2x+b = 0 \\
\Rightarrow x = -a, \text{ or } x = \frac{-b}{2} 
\]

Q26 Let the sides of the two squares be \( x \) cm and \( y \) cm where \( x > y \).

Then, their areas are \( x^2 \) and \( y^2 \) and their perimeters are \( 4x \) and \( 4y \).

By the given condition, \( x^2 + y^2 = 400 \) and \( 4x - 4y = 16 \)

\[ 4x - 4y = 16 \Rightarrow 4(x - y) = 16 \Rightarrow x - y = 4 
\]

\[ \Rightarrow x = y + 4 \ldots (1) \]
Substituting the value of \( y \) from (1) in \( x^2 + y^2 = 400 \), we get that \((y+4)^2 + y^2 = 400\)

\[
\Rightarrow y^2 + 16 + 8y + y^2 = 400 \\
\Rightarrow y^2 + 4y - 192 = 0 \\
\Rightarrow y^2 + 16y - 12y - 192 = 0 \\
\Rightarrow y(y+16) - 12(y+16) = 0 \\
\Rightarrow (y+16) (y-12) = 0
\]

\( y = -16 \) or \( y = 12 \)

since, the value of \( y \) cannot be negative, the value of \( y = 12 \).

So, \( x = y+4 = 12+4 = 16 \)

Thus, the sides of the two squares are 16 cm and 12 cm.

Q27

Given that, \( S_7 = 49 \) and \( S_{17} = 289 \)

\[
S_n = \frac{n}{2} [ 2a + (n-1)d ]
\]

\[
\therefore S_7 = 49 = \frac{7}{2} [ 2a + (7-1)d ] \Rightarrow 49 = \frac{7}{2} = (2a + 6d) \\
\Rightarrow (a + 3d) = 7 \text{ ...(i)}
\]

Similarly, \( S_{17} = \frac{17}{2} [ 2a + (17 - 1)d ] \)

\[
\therefore 289 = \frac{17}{2} [ 2a + 16d ] \\
\Rightarrow (a + 8d) = 17 \text{ ...(ii)}
\]

Subtracting equation (i) from equation (ii), we get that \( 5d = 10 \).

Therefore, the value of \( d = 2 \) and \( a = 7 - 3d = 1 \)

\[
\therefore S_n = \frac{n}{2} [2a + (n-1)d] = \frac{n}{2} [2(1) + (n-1)(2)] \\
= \frac{n}{2} (2+2n-2) = \frac{n}{2} (2n) = n^2
\]

Therefore, the sum of \( n \) terms of the AP is \( n^2 \).
Q28

Given: A circle C (0, r) and a tangent l at point A.

To prove: OA \perp l

Construction: take a point B, other than A, on the tangent l. Join OB. Suppose OB meets the circle in C.

Proof: we know that, among all line segment joining the point O to a point on l, the perpendicular is shortest to l.

OA = OC (Radius of the same circle)

Now, OB = OC + BC.

Therefore, OB > OC

\[ \Rightarrow \quad OB > OA \]

\[ \Rightarrow \quad OA > OB \]

B is an arbitrary point on the tangent l. thus, OA is shorter than any other line segment joining O to any point on l.

Hence, proved.

Q29

Given: l and m at are two parallel tangents to the circle with centre touching the circle at A and B respectively. DE is a tangent at the point C, which intersects l at D and m at E.

To prove: \( \angle DOE = 90^\circ \)

Construction: Join OC.

Proof:
In \( \triangle ODA \) and \( \triangle ODC \),

- \( OA = OC \) (Radii of the same circle)
- \( AD = DC \) (Length of tangents drawn from an external point to a circle are equal)
- \( DO = OD \) (Common side)

\( \triangle ODA \cong \triangle ODC \) (SSS congruence criterion)

\[ \therefore \angle DOA = \angle COD \quad \ldots(1) \quad \text{(C.P.C.T)} \]

Similarly, \( \triangle OEB \cong \triangle OEC \)

\[ \angle EOB = \angle COE \quad \ldots(2) \]

AOB is a diameter of the circle. Hence, it is a straight line.

\[ \therefore \angle DOA + \angle COD + \angle COE + \angle EOB = 180^0 \]

From (1) and (2), we have

\[ 2 \angle COD + 2 \angle COE = 180^0 \]

\[ \Rightarrow \angle COD + \angle COE = 90^0 \]

\[ \Rightarrow \angle DOE = 90^0 \]

Hence, proved.

**Q30**

Let AB be the building and CD be the tower. Suppose the height of the building be \( h \) m.

Given, \( \angle ACB = 30^0 \), \( \angle CBD = 60^0 \) and CD = 60 m

In right \( \triangle BCD \):

\[ \cot 60^0 = \frac{BC}{CD} \Rightarrow BC = CD \cot 60^0 \]
\[ BC = 60 \, \text{m} \times \frac{1}{\sqrt{3}} \Rightarrow BC = \frac{60}{\sqrt{3}} \, \text{m} = \frac{60\sqrt{3}}{3} \, \text{m} = 20\sqrt{3} \, \text{m} \quad \text{(1)} \]

In right \( \triangle ACB \):

\[
\tan 30^\circ = \frac{AB}{BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{20\sqrt{3}} \quad \text{(Using (1))} \Rightarrow h = 20 \, \text{m}
\]

Thus, the height of the building is 20 m.

\[ Q31 \]

Since the group consists of 12 persons, sample space consists of 12 persons.

\[ \therefore \text{Total number of possible outcomes} = 12 \]

Let \( A \) denote event of selecting persons which are extremely patient

\[ \therefore \text{Number of outcomes favorable to } A \text{ is 3.} \]

Let \( B \) denote event of selecting persons which are extremely kind or honest.

Number of persons which are extremely honest is 6.

Number of persons which are extremely kind is \( 12 - (6 + 3) = 3 \)

\[ \therefore \text{Number of outcomes favorable to } B = 6 + 3 = 9. \]

(i) Probability of selecting a person who is extremely patient is given by \( P(A) \).

\[ P(A) = \frac{\text{Number of outcomes favourable to } A}{\text{Total number of possible outcomes}} = \frac{3}{12} = \frac{1}{4} \]

(ii) Probability of selecting a person who is extremely kind or honest is given by \( P(B) \).

\[ P(B) = \frac{\text{Number of outcomes favourable to } B}{\text{Total number of possible outcomes}} = \frac{9}{12} = \frac{3}{4} \]
Q32

The three vertices of the parallelogram ABCD are A(3,-4), B(-1,-3) and C(-6,2).

Let the coordinates of the vertex D be (x,y)

It is known that in a parallelogram, the diagonals bisect each other.

∴ Mid point of AC = Mid point of BD

Therefore

\[
\left(\frac{3-6}{2}, \frac{-4+2}{2}\right) = \left(\frac{-1+x}{2}, \frac{-3+y}{2}\right)
\]

\[
\left(\frac{-3}{2}, \frac{-2}{2}\right) = \left(\frac{-1+x}{2}, \frac{-3+y}{2}\right)
\]

\[\therefore x = -2, y = 1\]

So, the coordinates of the vertex D is (-2,1).

Now, area of parallelogram ABCD

= area of triangle ABC + area of triangle ACD

= 2 \times area of triangle ABC [ Diagonal divides the parallelogram into two triangles of equal area ]

The area of a triangle whose vertices are \((x_1,y_1), (x_2,y_2)\) and \((x_3,y_3)\) is given by the numerical value of the expression \[\frac{1}{2} \left( x_1 (y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2) \right)\]

Area of triangle ABC = \[\frac{1}{2} \left( 3(-3-2) + (-1) \{2-(-4)\} + (-6) \{-4-(-3)\} \right) \]

= \[\frac{1}{2} \left( 3 \times (-5) + (-1) \times 6 + (-6) \times (-1) \right) = \frac{1}{2} \left( -15+6 \right) = -\frac{15}{2}\]

∴ Area of triangle ABC = \[\frac{15}{2}\] sq units (Area of the triangle cannot be negative)

Thus, the area of parallelogram ABCD = \[2 \times \frac{15}{2} = 15\] sq units.

Q33

Diameter of circular end of pipe = 2 cm

∴ Radius \((r_1)\) of circular end of pipe = \[\frac{2}{200}\] m = 0.01 m.

Area of cross-section = \[\pi \times r_1^2 = \pi \times (0.01)^2 = 0.0001 \pi \ m^2\]

Speed of water = 0.4 m/s = 0.4 \times 60 = 24 metre/min

Volume of water that flows in 1 minute from pipe = \[24 \times 0.0001 \pi \ m^3 = 0.0024 \pi \ m^3\]
Volume of water that flows in 30 minutes from pipe = \(30 \times 0.0024 \pi \ m^3 = 0.072 \pi \ m^3\)

Radius \(r_2\) of base of cylindrical tank = 40 cm = 0.4 m

Let the cylindrical tank be filled up to \(h\) m in 30 minutes.

Volume of water filled in tank in 30 minutes is equal to the volume of water flowed in 30 minutes from the pipe.

\[
\pi \times (r_2)^2 \times h = 0.072 \pi \\
\Rightarrow (0.4)^2 \times h = 0.072 \\
\Rightarrow 0.16 \times h = 0.072 \\
\Rightarrow h = \frac{0.072}{0.16} \\
\Rightarrow h = 0.45 \text{ m} = 45 \text{ cm}
\]

Therefore, the rise in level of water in the tank in half an hour is 45 cm.

Q34

Diameter of upper end of bucket = 30 cm

\[ \therefore \text{Radius } (r_1) \text{ of upper end of bucket} = 15 \text{ cm} \]

Diameter of lower end of bucket = 10 cm

\[ \therefore \text{Radius } (r_2) \text{ of lower end of bucket} = 5 \text{ cm} \]

Height \(h\) of bucket = 24 cm

Slant height \(l\) of frustum = \(\sqrt{(r_1 - r_2)^2 + h^2}\)

\[
=\sqrt{(15 - 5)^2 + (24)^2} = \sqrt{(10)^2 + (24)^2} = \sqrt{100 + 576} \\
=\sqrt{676} = 26 \text{ cm}
\]
Area of metal sheet used to make the bucket = \(\pi (r_1 + r_2)l + \pi r_2^2 = \pi (15 + 5)26 + \pi (5)^2\)

\[= 520\pi + 25\pi = 545\pi \text{ cm}^2\]

Cost of 100 cm\(^2\) metal sheet = Rs 10

Cost of 545\(\pi\) cm\(^2\) metal sheet = Rs \[\frac{545 \times 3.14 \times 10}{100}\] = Rs. 171.13

Therefore, cost of metal sheet used to make the bucket is Rs 171.13.