**CBSE Sample Paper-02 (Solved)**
**SUMMATIVE ASSESSMENT –II**
**MATHEMATICS**
**Class – X**

Time allowed: 3 hours | Maximum Marks: 90

**General Instructions:**

a) All questions are compulsory.
b) The question paper consists of 31 questions divided into four sections – A, B, C and D.
c) Section A contains 4 questions of 1 mark each which are multiple choice questions, Section B contains 6 questions of 2 marks each, Section C contains 10 questions of 3 marks each and Section D contains 11 questions of 4 marks each.
d) Use of calculator is not permitted.

## Section A

1. In an AP, if $a = 5$, $d = 2.5$, $a_n = 10$, then the value of $n$ is:

   (a) 1 (b) 2 (c) 3 (d) 4

2. If in a $\Delta$ABC, $\angle$C = $90^\circ$ and $\angle$B = $45^\circ$, then state which of the following is true:

   (a) Base = Perpendicular (b) Base = Hypotenuse
   (c) Perpendicular = Hypotenuse (d) Base + Perpendicular = Hypotenuse

3. The probability that two different friend have different birthdays (ignoring a leap year) is:

   (a) $\frac{364}{365}$ (b) $\frac{1}{365}$ (c) $\frac{1}{73}$ (d) $\frac{3}{73}$

4. The centroid of the triangle whose vertices are $(x_1, y_1), (x_2, y_2)$ and $(x_3, y_3)$ is:

   (a) $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$ (b) $(x_1+x_2+x_3, y_1+y_2+y_3)$
   (c) $\left(\frac{x_1+x_2+x_3}{6}, \frac{y_1+y_2+y_3}{6}\right)$ (d) $\left(\frac{x_1+x_2+x_3}{4}, \frac{y_1+y_2+y_3}{4}\right)$

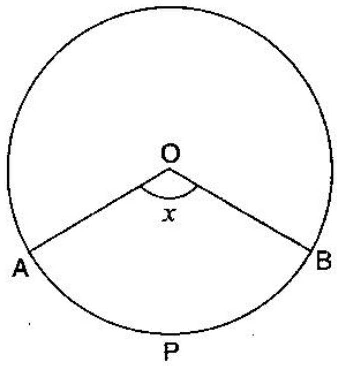
## Section B

5. If 1 is a zero of the polynomial $p(x) = ax^2 - 3(a-1)x - 1$, then find the value of $a$.

6. If the first term of an AP is $-4$ and the common difference is 2, then find the sum of first 10 terms.

7. If $a, b$ and $c$ are the sides of a right angled triangle where $c$ is the hypotenuse, then prove that the radius $r$ of the circle which touches the sides of the triangle is given by $r = \frac{a+b-c}{2}$.

8. In the figure, O is the centre of the circle. The area of sector OAPB is $\frac{5}{18}$ of the area of the circle. Find $x$.




9. How many shots each having radius 3 cm can be made from a cubical lead solid of dimensions 49 cm x 36 cm x 22 cm?

10. Three cubes of a metal whose edges are in the ratio 3 : 4 : 5 are melted and converted into a single cube of diagonal $24\sqrt{3}$ cm. Find the edges of the three cubes.

**Section C**

11. Solve the quadratic equation: $\sqrt{3}x^2 - 2\sqrt{2}x - 2\sqrt{3} = 0$

12. The sum of $n$ terms of an AP is $3n^2 + 5n.$ Find the AP and hence find its 16th term.

13. A point P is 13 cm from the centre of the circle. The length of the tangent drawn from P to the circle is 12 cm. Find the radius of the circle.

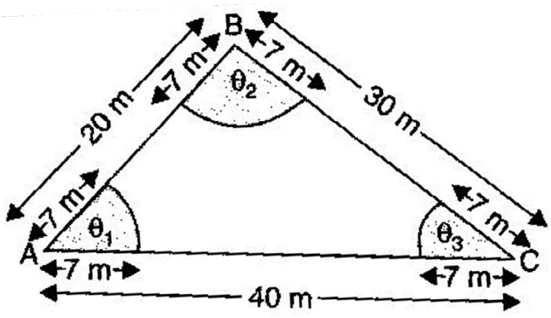
14. The angles of depression of the top and the bottom of a building 50 meters high as observed from the top of a tower are $30^\circ$ and $60^\circ$ respectively. Find the height of the tower and the horizontal distance between the building and the tower. $\left(\text{Take } \sqrt{3} = 1.73\right)$

15. Cards marked with the numbers 2 to 101 are placed in a box and mixed thoroughly. One card is drawn from this box. Find the probability that the number on the card is:
   (i) an even number.
   (ii) a number less than 14.
   (iii) a number which is a perfect square.

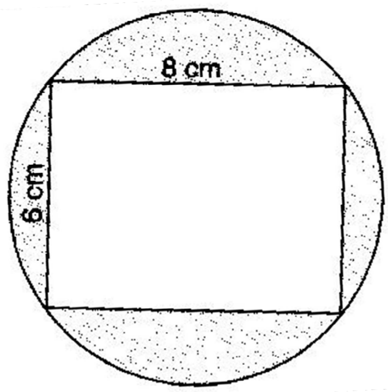
16. Find the ratio in which the point $(-3, k)$ divides the line segment joining the points $(-5, -4)$ and $(-2, 3)$. Hence, find the value of $k$.

17. Show that the points A (1, 2), B (5, 4), C (3, 8) and D$(-1, 6)$ are the vertices of a square.

18. Three horses are tethered at 3 corners of a triangular plot having sides 20 m, 30 m, 40 m with ropes of 7 m length each. Find the area of the plot which can be grazed by the horses. $\left(\text{Use } \pi = \dfrac{22}{7}\right)$




19. A rectangle 8 cm x 6 cm is inscribed in a circle as shown in figure. Find the area of the shaded region. $(\text{Use } \pi = 3.14)$




20. A solid iron rectangular block od dimensions 4.4 m x 2.6 m x 1 m is cast into a hollow cylindrical pipe of internal radius 30 cm and thickness 5 cm. Find the length of the pipe.

**Section D**

21. Solve for $x$: $\quad abx^2 + \left(b^2 - ac\right)x - bc = 0$

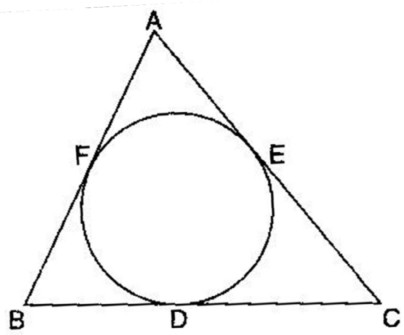
22. Sum of the areas of two squares is 468 m². If the difference of their perimeters is 24 m, then find the sides of two squares.

23. Ram asks the labour to dig a well up to a depth of 10 m. Labour charges `150 for first meter and `50 for each subsequent meters. As labour was uneducated, he claims `550 for the whole work.
Read the above passage and answer the following questions:
(i) What should be the actual amount to be paid to the labour?
(ii) What value of Ram is depicted in the question, if he pays `600 to the labour?

[Value Based Question]

24. The incircle of $\Delta$ ABC touches the sides BC, CA and AB at D, E and F respectively. Show that:

$$AF + BD + CD = AE + BF + CE = \frac{1}{2} \text{ (Perimeter of } \Delta \text{ ABC)}$$




25. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

    Using the above result, prove the following:
    A tangent PQ at a point P of a circle of radius 5 cm meets a line through the centre of a point Q so that OQ = 13 cm. Find the length of PQ.

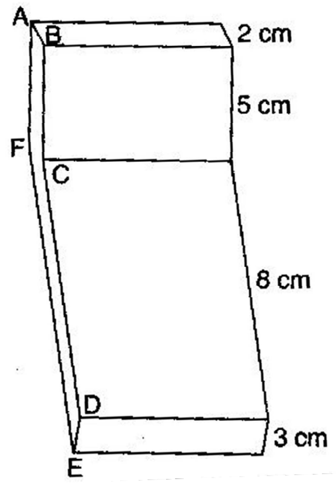
26. Draw a circle of radius 3 cm. From a point 5 cm away from the centre of the circle, draw two tangents to the circle. Find the lengths of the tangents.

27. The angle of elevation of the top of a tower as observed from a point on the ground is '$\alpha$' and moving '$a$' meters towards the tower, the angle of elevation is '$\beta$'. Prove that the height of the tower is $\dfrac{a\tan\alpha\tan\beta}{\tan\beta-\tan\alpha}$.

28. A card is drawn at random from a well-shuffled deck of playing cards. Find the probability that the card drawn is:
    (i) a king or a jack
    (ii) a non-ace
    (iii) a red card
    (iv) neither a king nor a queen.

29. Find the coordinates of the points which divide the line segment joining the points $(-4,0)$ and (0, 6) in three equal parts.

30. In figure, the shape of a solid copper piece (made of two pieces) with dimensions is shown. The face of ABCDEFA is the uniform cross-section. Assume that the angles at A, B, C, D, E and F are right angles, calculate the volume of the piece.




31. A milk container is in the form of a frustum of cone of height 18 cm with radius of its upper and lower ends as 8 cm and 32 cm respectively. Find the amount of milk which can completely fill the container and its cost at the rate of Rs.20 per litre. $\left(\text{Use } \pi = 3.14\right)$

# CBSE Sample Paper-02 (Solved)
## SUMMATIVE ASSESSMENT –II
## MATHEMATICS
## Class – X

(Solutions)

### SECTION-A

1. (b)
2. (a)
3. (a)
4. (a)
5. $p(1)=0$

$\Rightarrow \quad a(1)^3-3(a-1)(1)-1=0 \quad \Rightarrow \quad a-3a+2=0$

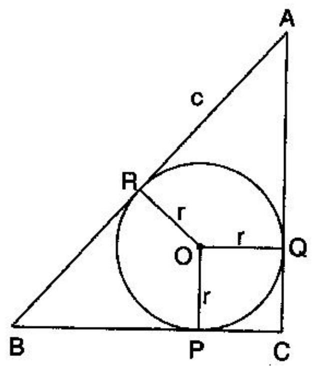
$\Rightarrow \quad -2a+2=0 \quad \Rightarrow \quad a=1$

6. $a=-4,\ d=2,\ n=10$

$\because \quad S_n=\frac{n}{2}\left[2a+(n-1)d\right]$

$\therefore \quad S_{10}=\frac{10}{2}\left(2\times(-4)+(10-1)2\right)$ = 5 x 10 = 50

7. AB = AR + BR




$\Rightarrow \quad c$ = AQ + BP

$\Rightarrow \quad c$ = (AC – CQ) + (BC – PC)

$\Rightarrow \quad c = (b-r)+(a-r)$

$\Rightarrow \quad c = a+b-2r$

$\Rightarrow \quad r=\frac{a+b-c}{2}$

8. Area of sector = $\frac{\theta}{360°}\pi r^2$

According to question,

$$\frac{\theta}{360°}\pi r^2 = \frac{5}{18}\pi r^2$$

$\Rightarrow \quad x=100°$

9. Let $n$ shots be made. Then,

According to question,

Volume of $n$ shots = Volume of cuboid

$\Rightarrow \quad n.\frac{4}{3}=\pi r^3=49\times36\times22$

$\Rightarrow \quad n.\frac{4}{3}\times\frac{22}{7}.(3)^3 = 49\times36\times22 \quad \Rightarrow \quad n=\frac{49\times36\times22\times7\times3}{4\times22\times27} \quad \Rightarrow n = 363.4$

10. Let the edges of three cubes (in cm) be $3x, 4x$ and $5x$ respectively. Then,

Volume of the cubes after melting = $(3x)^3+(4x)^3+(5x)^3$ = $216x^3$ cm$^3$

Let the edge of the new cube be $a$ cm. Then,

$a^3 = 216x^3 \quad \Rightarrow \quad a = 6x$

$\therefore$ Diagonal = $a\sqrt{3} = 6\sqrt{3}x$

And $6\sqrt{3}x = 24\sqrt{3} \quad \Rightarrow \quad x = 4$

Hence, the edges of the three cubes are 12 cm, 16 cm and 20 cm.

11. $\sqrt{3}x^2 - 2\sqrt{2}x - 2\sqrt{3} = 0 \quad \Rightarrow \quad \sqrt{3}x^2 - 3\sqrt{2}x + \sqrt{2}x - 2\sqrt{3} = 0$

$\Rightarrow \quad \sqrt{3}x\left(x-\sqrt{3}\sqrt{2}\right)+\sqrt{2}\left(x-\sqrt{2}\sqrt{3}\right)=0$

$\Rightarrow \quad \left(x-\sqrt{6}\right)\left(\sqrt{3}x+\sqrt{2}\right)=0$

$\Rightarrow \quad x=\sqrt{6}, \frac{-\sqrt{2}}{\sqrt{3}}$

12. $S_n = 3n^2 + 5n$

$S_1 = 3(1)^2 + 5(1) = 8$

$S_2 = 3(2)^2 + 5(2) = 22$

$\therefore \quad a_1 = 8, \quad a_2 = S_2 - S_1$ = 22 – 8 = 14

$\therefore \quad d = a_2 - a_1$ = 14 – 8 = 6

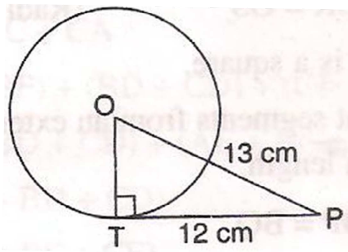
$\therefore$ AP is 8, 14, 20, 26, ........

And $a_{16} = a + 15d$ = 8 + 15 x 6 = 98

13. $OT^2 = OP^2 - PT^2$ [By Pythagoras theorem]

$\Rightarrow$ $OT^2 = 13^2 - 12^2 = 169 - 144 = 25$

$\Rightarrow$ OT = 5 cm




14. In right $\Delta$ CEA,

$\tan 30^\circ = \frac{CE}{AE}$

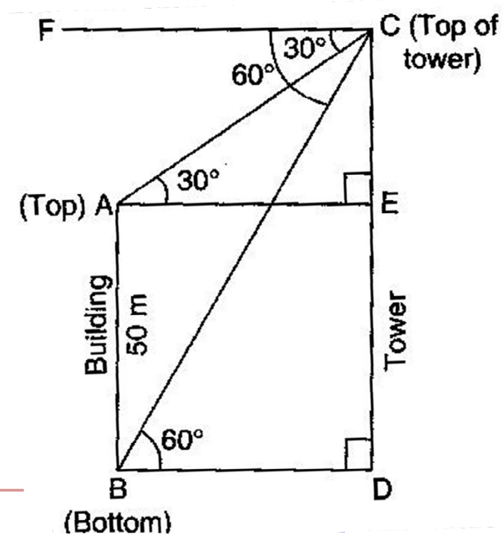
$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{CE}{AE}$ ..........(i)

In right $\Delta$ CDB,

$\tan 60^\circ = \frac{CD}{BD}$

$\Rightarrow \quad \sqrt{3} = \frac{CE + 50}{BD}$ ..........(ii)

Dividing eq. (i) by eq. (ii), we get,



$$\frac{1}{3} = \frac{CE}{CE + 50} \qquad [\because BD = AE]$$

$\Rightarrow$ CE = 25 m

$\therefore$ CD = CE + ED = 25 + 50 = 75 m

From eq. (i),

$$\frac{1}{\sqrt{3}} = \frac{CE}{AE} \qquad \Rightarrow \qquad AE = 25\sqrt{3} = 25 \times 1.73 = 43.25 \text{ m}$$

15. There are 100 cards in the box, out of which one card can be drawn in 100 ways.

$\therefore$ Total number of possible outcome = 100

(i) From number 2 to 101, there are 50 even numbers, namely [2, 4, 6, .....100]. Out of these 50 even numbered cards, one card can be chosen in 50 ways.-

Hence, P (getting an even numbered card) = $\frac{50}{100} = \frac{1}{2}$

(ii) There are 12 cards bearing numbers less than 14, i.e., namely [2, 3, 4, ......13].

Hence required probability = $\frac{12}{100} = \frac{3}{25}$

(iii) The perfect squares numbers from 2 to 101 are 4, 9, 16, 25, 36, 49, 64, 81, 100 i.e. squares of 2, 3, 4, 5......10 respectively.

Therefore there are 9 cards marked with the numbers which are perfect squares.

Hence, required probability = $\frac{9}{100}$

16. Let the ratio be $\lambda : 1$. Then, according to question,

$$\frac{(-2\lambda) + (-5)}{\lambda + 1} = -3 \qquad \Rightarrow \qquad \frac{-2\lambda - 5}{\lambda + 1} = -3$$

$\Rightarrow$ $-2\lambda - 5 = -3\lambda - 3$ $\qquad \Rightarrow \qquad$ $-2\lambda + 3\lambda = -3 + 5$

$\Rightarrow$ $\lambda = 2$

Also, $\frac{3\lambda - 4}{\lambda + 1} = k$ $\qquad \Rightarrow \qquad$ $\frac{3 \times 2 - 4}{2 + 1} = k$

$\Rightarrow$ $k = \frac{6 - 4}{3}$ $\qquad \Rightarrow \qquad$ $k = \frac{2}{3} = 2 : 3$

17. Given, A (1, 2), B (5, 4), C (3, 8) and D $(-1, 6)$

AB = $\sqrt{(5-1)^2 + (4-2)^2} = \sqrt{4^2 + 2^2} = \sqrt{20} = 2\sqrt{5}$ units

BC = $\sqrt{(3-5)^2 + (8-4)^2} = \sqrt{(-2)^2 + (4)^2} = \sqrt{20} = 2\sqrt{5}$

CD = $\sqrt{(-1-3)^2 + (6-8)^2} = \sqrt{(-4)^2 + (-2)^2} = \sqrt{20} = 2\sqrt{5}$

DA = $\sqrt{(-1-1)^2 + (6-2)^2} = \sqrt{(-2)^2 + (4)^2} = \sqrt{20} = 2\sqrt{5}$

And diagonals

AC = $\sqrt{(3-1)^2+(8-2)^2}$ = $\sqrt{(2)^2+(6)^2}=\sqrt{40}=2\sqrt{10}$

BD = $\sqrt{(-1-5)^2+(6-4)^2}$ = $\sqrt{(-6)^2+(2)^2}=\sqrt{40}=2\sqrt{10}$

Hence, all four sides and two diagonals are equal.

Therefore ABCD is a square.

18. Required area,

$$=\pi r^2\frac{\theta_1}{360°}+\pi r^2\frac{\theta_2}{360°}+\pi r^2\frac{\theta_3}{360°}$$

$$=\frac{\pi r^2}{360°}(\theta_1+\theta_2+\theta_3)$$

$$=\frac{\pi r^2}{360°}(180°) \qquad [\because \text{ Sum of all the angles of a triangle is } 180°]$$

$$=\frac{22}{7}\times7\times7\times\frac{180°}{360°}$$

= 77 $m^2$

19. Diagonal of the rectangle = $\sqrt{8^2+6^2}=\sqrt{64+36}=\sqrt{100}=$ 10 cm

$\therefore$ Radius of the circle = $\frac{10}{2}$ = 5 cm

$\therefore$ Area of the circle = $\pi.5^2$ = 3.14 x 5 x 5 = 78.5 $cm^2$

$\therefore$ Area of rectangle = 8 x 6 = 48 $cm^2$

$\therefore$ Required area = 78.5 – 48 = 30.5 $cm^2$

20. Let the length of the pipe be $x$ cm.

According to question,

Volume of hollow cylinder = Volume of rectangular block

$\Rightarrow$ $\pi\left(r_1^2-r_2^2\right)h-l\times b\times h$

$\Rightarrow$ $\pi\left[(30+5)^2-(30)^2\right]x=$ 4.4 x 2.6 x 1 x 100 x 100 x 100

$\Rightarrow$ $3.14[1225-900]x=$ 11.44 x 1000000

$\Rightarrow$ 1020.5. $x$ = 11440000

$\Rightarrow$ $x$ = 112 m

21. $abx^2+\left(b^2-ac\right)x-bc=0$

$\Rightarrow$ $abx^2+b^2x-acx-bc=0$

$\Rightarrow$ $bx(ax+b)-c(ax+b)=0$

$\Rightarrow$ $(ax+b)(bx-c)=0$

$\Rightarrow$ $x=\frac{-b}{a},\frac{c}{b}$

22. Let the side of the larger square be $x$ m. Then its perimeter = $4x$ m

Perimeter of the larger square – Perimeter of the smaller square = 24 m

$\Rightarrow$ $4x-$ Perimeter of the smaller square = 24

$\Rightarrow$ Perimeter of the smaller square = $(4x-24)$ m

$\Rightarrow$ Side of the smaller square = $\dfrac{4x-24}{4}=(x-6)$ m

According to the question,

Area of the larger square + Area of the smaller square = 468 m²

$\Rightarrow$ $x^2+(x-6)^2=468$ $\Rightarrow$ $x^2+x^2-12x-432=0$

$\Rightarrow$ $2x^2-12x-432=0$ $\Rightarrow$ $x^2-6x-216=0$

$\Rightarrow$ $x^2-18x+12x-216=0$ $\Rightarrow$ $x(x-18)+12(x-18)=0$

$\Rightarrow$ $(x-18)(x+12)=0$ $\Rightarrow$ $x=18,-12$

$x=-12$ is inadmissible as $x$ is the length of a side which cannot be negative.

$\therefore$ $x=18$ and $x-6=12$

Hence, the sides of the two squares are 18 m and 12 m.

23. (i) Here, amount form an AP.

First term, $a$ = Labour charge for first meter = `150

Since Labour charge increasing by `50 for each subsequent meters.

$\therefore$ $d=50$

Total depth = 10 m

$\therefore$ Labour charge for 10 m = $a+(n-1)d$

= 150 + (10 – 1) x 50 = 150 + 9 x 50

= 150 + 450 = 600

Hence `600 should be paid to the labours.

(ii) If Ram pays `600 to the labour, then it shows his honesty and sincerety.

24. $\because$ Tangent segments from an external point to a circle are equal in length.

$\therefore\therefore$ AE = AF BF = BD CD = CE

$\Rightarrow$ AF + BD + CD = AE + BF + CE ..........(i)

Also, Perimeter of $\Delta$ABC

= AB + BC + CA

= (AF + BF) + (BD + CD) + (CE + AE)

= (AF + BD + CD) + (AE + BF + CE)

= 2(AF + BD + CD) [From eq. (i)]

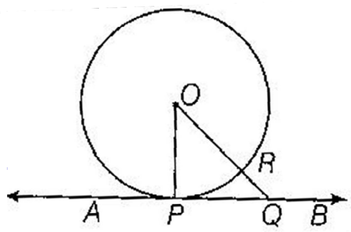
= 2(AE + BF + CE)

$\therefore$ Perimeter of $\Delta$ABC = 2 (AE + BF + CE)

25. **First part**: Given : A circle with centre O and radius $r$ and a tangent AB at a point P.

To Prove : OP $\perp$ AB

Construction : Take any point Q, other than P on the tangent AB. Join OQ. Suppose OQ meets the circle at R.



Proof : Clearly $OP = OQ$ [Radii]

Now, $OQ = OR + RQ$

$\Rightarrow$ $OQ > OR$

$\Rightarrow$ $OQ > OP$ [$OP = OQ$]

$\Rightarrow$ $OP < OQ$

Thus, OP is shorter than any segment joining O to any point of AB.

So, OP is perpendicular to AB.

Hence,

$OT = OT'$ ……. (Radii of the same circle)

and $OP = OP$ ……..(Common)

$\therefore$ $\Delta OTP \cong \Delta OT'P$ ……..(RHS congruency)

Hence, $OP \perp AB$

**Second part**: Using the above, we get,

$\angle OPQ = 90^\circ$

$\therefore$ $PQ = \sqrt{OQ^2 - OP^2}$ [By Pythagoras theorem]

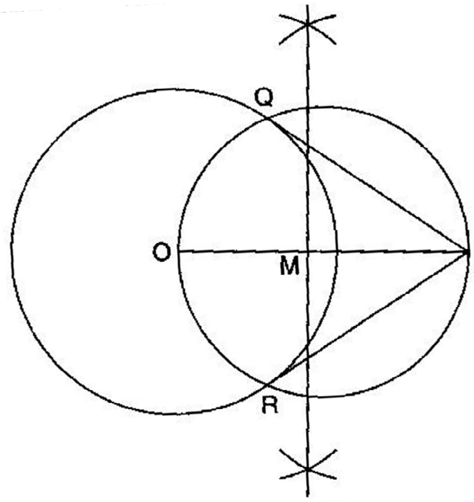
$\Rightarrow$ $PQ = \sqrt{13^2 - 5^2} = 12$ cm

26. **Steps of construction**:
   (a) Draw a circle with O as centre and radius equal to 3 cm.
   (b) Draw OP = 5 cm and bisect it. Let M be the mid-point of OP.
   (c) Taking M as centre and OM as radius , draw a circle. Let it intersect the given circle at Q and R.
   (d) Join PQ and PR.

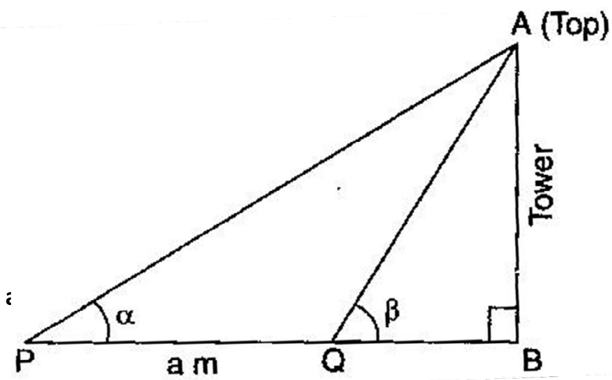
   Then PQ and PR are the required two tangents.

   On measurement,

   $PQ = PR = 4$ cm




27. In right triangle ABP,



$$\tan\alpha = \frac{AB}{a + QB} \qquad \text{..........(i)}$$

In right triangle ABQ, $\tan\beta = \frac{AB}{QB}$

$\Rightarrow \qquad QB = \frac{AB}{\tan\beta} \qquad$ ..........(ii)

Putting the value of QB from eq. (ii) in eq. (i), we get,

$$\tan\alpha = \frac{AB}{a + \frac{AB}{\tan\beta}} = \frac{AB\ \tan\beta}{a\tan\beta + AB}$$

$\Rightarrow \qquad a\tan\alpha\tan\beta + AB\ \tan\alpha = AB\ \tan\beta$

$\Rightarrow \qquad AB(\tan\beta - \tan\alpha) = a\tan\alpha\tan\beta$

$\Rightarrow \qquad AB = \frac{a\tan\alpha\tan\beta}{\tan\beta - \tan\alpha}$

28. Total number of cards in the deck = 52

$\therefore$ Number of all possible outcomes = 52

(i) Number of a king or a jack = 4 + 4 = 8

$\therefore$ Required probability = $\frac{8}{52} = \frac{2}{13}$

(ii) Number of a non-ace = 52 – 4 = 48

$\therefore$ Required probability = $\frac{42}{52} = \frac{12}{13}$

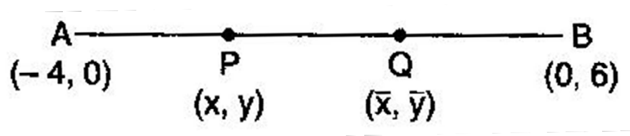
(iii) Number of a red card = 13 + 13 = 26

$\therefore$ Required probability = $\frac{26}{52} = \frac{1}{2}$

(iv) Number of neither a king nor a queen = 52 – (4 + 4) = 4

$\therefore$ Required probability = $\frac{44}{52} = \frac{11}{13}$

29. P divides AB internally in the ratio 1 : 2.




$\therefore \qquad x = \frac{1\times 0 + 2\times(-4)}{1+2} = \frac{-8}{3}$

And $\qquad y = \frac{1\times 6 + 2\times 0}{1+2} = 2$

$\therefore \qquad P \to \left(\frac{-8}{3}, 2\right)$

Since Q is the mid-point of PB.

$\therefore \quad \bar{x} = \dfrac{\frac{-8}{3}+0}{2} = \dfrac{-4}{3}$

And $\quad \bar{y} = \dfrac{2+6}{2} = 4$

$\therefore \quad Q \to \left(\dfrac{-4}{3}, 0\right)$

30. Volume of horizontal cuboid = $lbh$

= 22 x (8 + 2) x 3 = 22 x 10 x 3 = 660 cm$^3$

Volume of vertical cuboid = $lbh$

= 22 x 2 x 5 = 220 cm$^3$

$\therefore$ Total volume of piece

= 660 cm$^3$ + 220 cm$^3$

= 1180 cm$^3$

31. Given, $h$ = 18 cm

$r_1$ = 32 cm

$r_2$ = 8 cm

According to the question,

Amount of milk = Volume of frustum

$\Rightarrow$ Volume of frustum $= \dfrac{1}{3}\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$

$= \dfrac{1}{3} \times 3.14 \times 18\left[(32)^2 + (8)^2 + 32 \times 8\right]$

$= \dfrac{3.14 \times 18}{3}(1024 + 64 + 256)$

$= \dfrac{3.14}{3} \times 18 \times 1344$ = 25320.96 cm$^3$

Cost of milk = $\dfrac{25320.96 \times 20}{1000}$ = $\dfrac{506419.2}{1000}$ = Rs. 506.42