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SAMPLE TEST PAPER 09 FOR CLASS X BOARD EXAM 2021

CLASS: X
SUBJECT: MATHEMATICS

MAX. MARKS: 80
DURATION: 3 hrs

General Instruction:

1. This question paper contains two parts A and B.
2. Both Part A and Part B have internal choices.

Part – A:

1. It consists three sections- I and II.
2. Section I has 16 questions of 1 mark each. Internal choice is provided in 5 questions.
3. Section II has 4 questions on case study. Each case study has 5 case-based sub-parts. An examinee is to attempt any 4 out of 5 sub-parts.

Part – B:

1. Question No 21 to 26 are Very short answer Type questions of 2 mark each,
2. Question No 27 to 33 are Short Answer Type questions of 3 marks each
3. Question No 34 to 36 are Long Answer Type questions of 5 marks each.
4. Internal choice is provided in 2 questions of 2 marks, 2 questions of 3 marks and 1 question of 5 marks.

PART - A
SECTION-I

Questions 1 to 16 carry 1 mark each.

1. Write the sum of exponents of prime factors in the prime factorisation of 250.

Ans: $250 = 2 \times 5 \times 5 \times 5 = 2^1 \times 5^3$

\therefore Sum of exponents = $1 + 3 = 4$

OR

If $xy = p^3q^4$ and $HCF(x,y) = pq^2$, then find the $LCM(x,y)$.

Ans: $LCM = p^3q^4$.

2. Find a quadratic polynomial, the sum and product of whose zeroes are -3 and 2 , respectively.

Ans: $x^2 + 3x + 2$

3. Find the number of solutions of the pair of equations $x + 2y - 4 = 0$ and $2x + 4y - 12 = 0$.

Ans: No Solutions

4. Check whether 301 is a term of the list of numbers 5, 11, 17, 23, ...

Ans: nth term = 301 $\Rightarrow a + (n - 1)d = 301 \Rightarrow 5 + (n - 1)6 = 301$

$\Rightarrow 5 + 6n - 6 = 301 \Rightarrow -1 + 6n = 301 \Rightarrow 6n = 301 + 1$

$\Rightarrow 6n = 302 \Rightarrow n = 302/6$ (Divide by 2)

$\Rightarrow n = 151/3$

Hence, $151/3$ is not a term of the given list of number.

OR

How many two-digit numbers are divisible by 3?

Ans: A.P = 12, 15, 18, ..., 99

Let us consider there are n numbers then

$an = 99$

$\Rightarrow a + (n - 1)d = 99 \Rightarrow 12 + (n - 1)3 = 99$

$\Rightarrow 12 + 3n - 3 = 99 \Rightarrow n = 29 + 1 \Rightarrow n = 30$

\therefore Two digit numbers divisible by 3 = 30.

5. For what values of k, the equation $9x^2 - 6kx + 4 = 0$ has equal roots?

Ans: $9x^2 - 6kx + 4 = 0$

$a = 9, b = -6k, c = 4$

$D = 36k^2 - 144 = 0$

$\Rightarrow k^2 = 4 \Rightarrow k = \pm 2$

OR

Find the roots of the equation $x^2 - 7x + 10 = 0$

Ans: 2, 5

6. Evaluate: $2 \tan^2 45^\circ + \cos^2 30^\circ - \sin^2 60^\circ$

Ans: 2

7. A line segment AB is to be divided in the ratio 7 : 6. Ray AX is drawn such that $\angle BAX$ is acute. Also ray BY is drawn parallel to AX and the points A_1, A_2, A_3, \dots and B_1, B_2, B_3, \dots are located at equal distances on rays AX and BY respectively. Which two points now will be joined?

Ans: A_7 to B_6 .

8. If TP and TQ are the two tangents to a circle with centre O so that $\angle POQ = 110^\circ$, then find $\angle PTQ$.

Ans: Let the angle be x

$90^\circ + 90^\circ + 110^\circ + x = 360^\circ$

$290^\circ + x = 360^\circ$

$x = 360^\circ - 290^\circ$

$x = 70^\circ$

OR

If tangents PA and PB from a point P to a circle with centre O are inclined to each other at angle of 80° , then find $\angle POA$.

Ans: PA & PB are tangent and O is tangent

$\Rightarrow \angle OAP = \angle OBP = 90^\circ$

PA and PB are inclined to each other at 80°

$\Rightarrow \angle APB = 80^\circ$

in Quadrilateral OAPB

$\angle AOB + \angle OAP + \angle APB + \angle OBP = 360^\circ$

$\Rightarrow \angle APB + 90^\circ + 80^\circ + 90^\circ = 360^\circ$

$\Rightarrow \angle APB = 100^\circ$

Now, $\angle POA = \angle POB = (1/2) \angle APB$

$\Rightarrow \angle POA = (1/2) 100^\circ \Rightarrow \angle POA = 50^\circ$

9. If one root of quadratic polynomial $2x^2 - 3x + k$ is reciprocal to the other, then find the value of k.

Ans: $a = 2, b = -3, c = k$

So, $\alpha \times 1/\alpha = c/a$

$\Rightarrow 1 = k/2 \Rightarrow k = 2$

The value of k is 2

10. If $\cot A = \frac{5}{12}$, then find the value of cosec A.

Ans: $\operatorname{cosec}^2 A = 1 + \cot^2 A = 1 + \left(\frac{5}{12}\right)^2 = 1 + \frac{25}{144} = \frac{169}{144} \Rightarrow \operatorname{cosec} A = \frac{13}{12}$

11. If the pair of linear equations $13x + ky = k$ and $39x + 6y = k + 4$ has infinitely many solutions, then find the value of k.

Ans: $a_1/a_2 = b_1/b_2 = c_1/c_2$

Putting Values we get,

$\Rightarrow 13/39 = k/6 = (-k)/-(k+4)$

$\Rightarrow 1/3 = k/6 = k/(k+4)$

Comparing First 2, Now, we get,

$\Rightarrow 1/3 = k/6$

$\Rightarrow 3k = 6 \Rightarrow k = 2$

12. The length of a tangent from a point A at distance 5 cm from the centre of the circle is 4 cm. Find the radius of the circle.
Ans: radius of the circle = 3 cm
13. A ladder is placed against a wall such that its foot is at a distance of 2.5 m from the wall and its top reaches a window 6 m above the ground. Find the length of the ladder.
Ans: Length of the ladder = 6.5 m
14. Find the area of a quadrant of a circle whose circumference is 22 cm.
Ans: 9.625 cm²
15. A cone of height 24 cm and radius of base 6 cm is made up of modelling clay. A child reshapes it in the form of a sphere. Find the radius of the sphere.
Ans: radius of the sphere = 6 cm
16. A lot of 20 bulbs contain 6 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is good?
Ans: $14/20 = 7/10$

OR

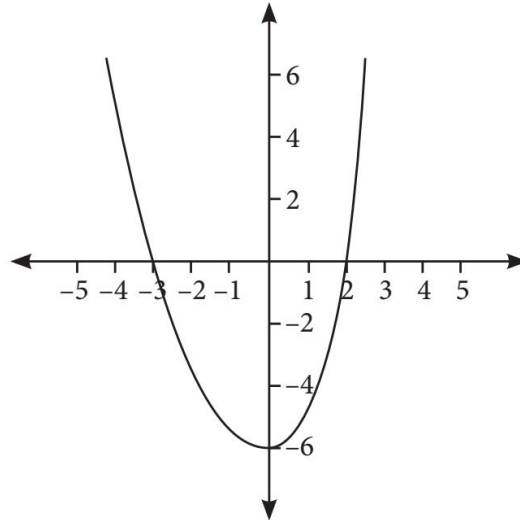
If two dice are thrown at the same time, then what will be the probability of getting doublet?
Ans: $6/36 = 1/6$

SECTION-II

Case study based questions are compulsory. Attempt any four sub parts of each question. Each subpart carries 1 mark

17. Case Study based-1: Heavy Storm

Aditya saw a creeper on the wall of his grandmother's house which was in the shape as shown in the figure. Answer the following questions, considered that creeper has a mathematical shape.



(i) How many zeroes does the polynomial (shape of the creeper) have?

- (a) 0 (b) 1 (c) 2 (d) 3

Ans: (c) 2

(ii) The zeroes of the polynomial are

- (a) 2, -3 (b) -2, 3 (c) 2, 1 (d) -3, 1

Ans: (a) 2, -3

(iii) Name the shape represents a polynomial.

- (a) Linear (b) Cubic (c) Quadratic (d) None of these

Ans: (c) Quadratic

(iv) The expression of the polynomial is

(a) $x^2 - x - 6$ (b) $x^2 + x - 6$ (c) $x^3 - x + 6$ (d) $x^3 - x^2 + x + 6$

Ans: (b) $x^2 + x - 6$

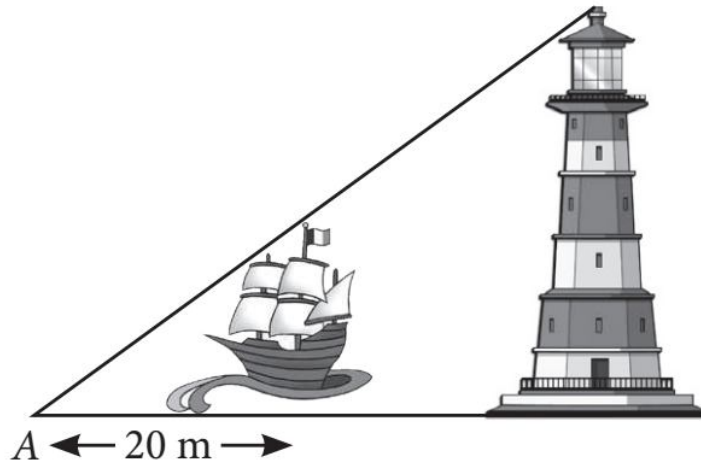
(v) For what value of x , the value of polynomial is 6?

(a) $x = 3$ (b) $x = -4$ (c) Both (a) and (b) (d) Can't be determined

Ans: (c) Both (a) and (b)

18. Case Study based-2:

Shweta went to a beach with her uncle. From a point A where Shweta was standing, a ship and lighthouse come in a straight line as shown in the figure.



(i) Which similarity criteria can be seen in this case, if ship and lighthouse are considered as straight lines?

(a) AA (b) SAS (c) SSS (d) ASA

Ans: (a) AA

(ii) The distance between Shweta and the ship is twice as much as the height of the ship. What is the height of the ship?

(a) 40 m (b) 10 m (c) 15 m (d) 25 m

Ans: (b) 10 m

(iii) If the distance of Shweta from the lighthouse is twelve times the height of the ship, then the ratio of the heights of ship and lighthouse is

(a) 3 : 1 (b) 1 : 4 (c) 1 : 6 (d) 2 : 3

Ans: (c) 1 : 6

(iv) What is the ratio of the distance between Shweta and top of ship to the distance between the tops of ship and lighthouse?

(a) 1 : 5 (b) 1 : 6 (c) 2 : 5 (d) Can't be determined

Ans: (a) 1 : 5

(v) What is the height of the lighthouse?

(a) 50 m (b) 60 m (c) 120 m (d) 30 m

Ans: (b) 60 m

19. Case Study based-3: 100m RACE

A stopwatch was used to find the time that it took a group of students to run 100 m.

Time (in sec)	0-20	20-40	40-60	60-80	80-100
No. of students	8	10	13	6	3



(i) Estimate the mean time taken by a student to finish the race.

- (a)54 (b)63 (c)43 (d)50

Ans: (c)43

(ii) What will be the upper limit of the modal class ?

- (a)20 (b)40 (c)60 (d)80

Ans: (c)60

(iii) The construction of cumulative frequency table is useful in determining the

- (a)Mean (b)Median (c)Mode (d)All of the above

Ans: (b)Median

(iv) The sum of lower limits of median class and modal class is

- (a)60 (b)100 (c)80 (d)140

Ans: (c)80

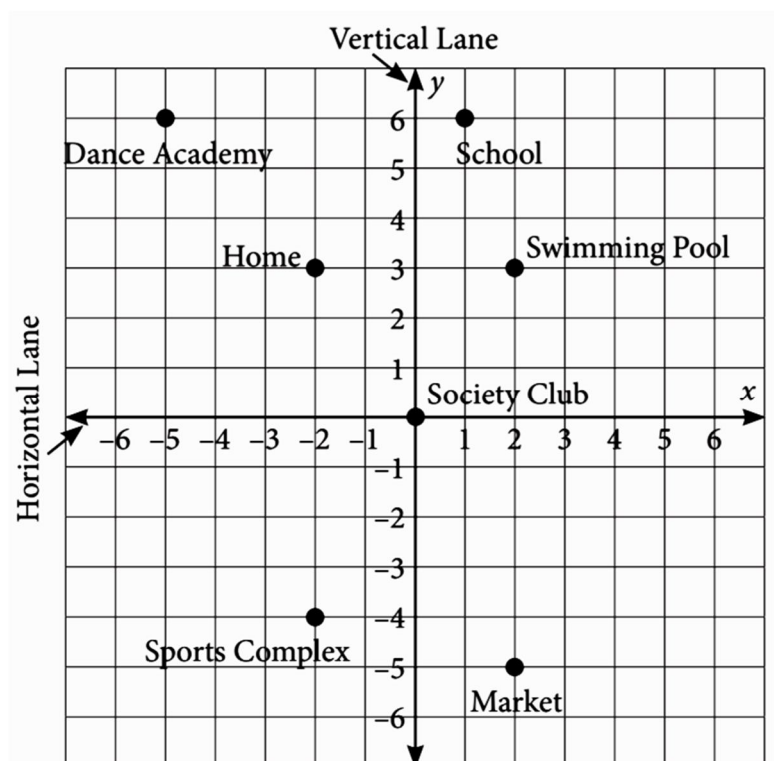
(v) How many students finished the race within 1 minute?

- (a)18 (b)37 (c)31 (d)8

Ans: (c)31

20. Case Study based-4:

Isha was making a survey on the facilities provided in her society. For that she represented the positions of various places near her home graphically as shown below.



(i) The distance of Market from Horizontal Lane is

- (a) 2 units (b) 5 units (c) 3 units (d) 7 units

Ans: (b) 5 units

(ii) What is the distance of Isha's home from society club?

- (a) $\sqrt{14}$ units (b) $\sqrt{5}$ units (c) $\sqrt{30}$ units (d) $\sqrt{13}$ units

Ans: (d) $\sqrt{13}$ units

(iii) The midpoint of line joining Sports complex and Dance Academy is

- (a) $(-7/2, 5)$ (b) $(3/2, 1)$ (c) $(-7/2, 1)$ (d) $(-3/2, -5)$

Ans: (c) $(-7/2, 1)$

(iv) The point dividing the line segment joining school and market in the ratio 2 : 1 is

- (a) $(5/3, -4/3)$ (b) $(1, 16/3)$ (c) $(4/3, 7/3)$ (d) None of these

Ans: (a) $(5/3, -4/3)$

(v) Which of the following options are equidistant from vertical lane?

- (a) Sports complex and Dance Academy (b) Isha's home and School
(c) Swimming pool and Isha's home (d) Swimming pool and market

Ans: (c) Swimming pool and Isha's home

PART – B

(Question No 21 to 26 are Very short answer Type questions of 2 mark each)

21. Find the largest number which divides 245 and 1037, leaving remainder 5 in each case.

Ans: Since we have given that

245 and 1037 are two numbers, leaving remainder 5 in each case.

So, our number becomes $245 - 5 = 240$ and $1037 - 5 = 1032$

So, H.C.F. of 240 and 1032 = 24

Hence, the largest number which divides 245 and 1037 leaving remainder 5 in each case is 24.

22. If (1, 2), (4, y), (x, 6) and (3, 5) are the vertices of a parallelogram taken in order, find x and y.

Let $A(1, 2)$, $B(4, y)$, $C(x, 6)$ and $D(3, 5)$ be the vertices of a parallelogram $ABCD$.

Since, the diagonals of a parallelogram bisect each other.

$$\therefore \left(\frac{x+1}{2}, \frac{6+2}{2} \right) = \left(\frac{3+4}{2}, \frac{5+y}{2} \right)$$

$$\Rightarrow \frac{x+1}{2} = \frac{7}{2}$$

$$\Rightarrow x+1 = 7 \quad \text{or} \quad x = 6$$

$$\Rightarrow 4 = \frac{5+y}{2} \quad 5+y = 8 \quad \text{or} \quad y = 8 - 5 = 3$$

Hence, $x = 6$ and $y = 3$.

OR

Find the ratio in which the x-axis divides the line segment joining the points $A(3, 6)$ and $B(12, -3)$.

P be $(x, 0)$

$$(x, 0)P = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$$

$$0 = \frac{m_1(-3) + m_2(6)}{m_1 + m_2} \Rightarrow -3m_1 + 6m_2 = 0 \Rightarrow 6m_2 = 3m_1$$

$$\Rightarrow \frac{m_1}{m_2} = \frac{6}{3} = \frac{2}{1} \Rightarrow m_1 : m_2 = 2 : 1$$

23. If the sum of the first 14 terms of an AP is 1050 and its first term is 10, find the 20th term.

Ans: 20th term is 200

NCERT Example 12 Chapter 05 p-109

24. In ΔOPQ , right-angled at P, $OP = 7$ cm and $OQ - PQ = 1$ cm. Determine the values of $\sin Q$ and $\cos Q$.

Ans: $\sin Q = 7/25$, $\cos Q = 24/25$

NCERT Example 5 Chapter 08 p-180

OR

If $\sin(A - B) = 1/2$, $\cos(A + B) = 1/2$, $0^\circ < A + B \leq 90^\circ$, $A > B$, find A and B.

Ans: $A = 45^\circ$ and $B = 15^\circ$.

NCERT Example 8 Chapter 08 p-186

25. Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle.

NCERT Exercise 11.2 Q1 p-221

26. A quadrilateral ABCD is drawn to circumscribe a circle. Prove that $AB + CD = AD + BC$.

Since the lengths of tangents drawn from an external point to a circle are equal,

$$\therefore AL = AR \quad \dots(1) \text{ [tangents from A]}$$

$$BL = BM \quad \dots(2) \text{ [tangents from B]}$$

$$CN = CM \quad \dots(3) \text{ [tangents from C]}$$

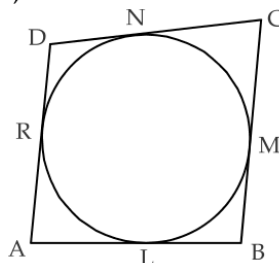
$$\text{and } DN = DR \quad \dots(4) \text{ [tangents from D]}$$

Adding (1) – (4), we get:

$$(AL + BL) + (CN + DN) = (AR + BM) + (CM + DR)$$

$$\text{Hence, } AB + DC = (AR + DR) + (BM + CM)$$

$$= AD + BC.$$



(Question no 27 to 33 are Short Answer Type questions of 3 marks each)

27. Prove that $\sqrt{7}$ is an irrational number.

Ans: Let us assume that $\sqrt{7}$ is a rational number.

ie $\sqrt{7} = p/q$, where p and q are co-prime numbers.

$$\sqrt{7} = p/q \Rightarrow p = \sqrt{7}q$$

squaring, we get

$$p^2 = 7q^2 \quad \dots\dots(1)$$

$$\Rightarrow p^2 \text{ is divisible by } 7 \Rightarrow p \text{ is also divisible by } 7$$

Let us assume $p = 7c$ where c is any integer

substituting values in (1)

$$(7c)^2 = 7q^2 \Rightarrow 49c^2 = 7q^2 \Rightarrow 7c^2 = q^2$$

$$\Rightarrow q^2 = 7c^2$$

$$\Rightarrow q^2 \text{ is divisible by } 7 \Rightarrow q \text{ is divisible by } 7$$

From above we conclude that p and q have at least one common factor 7.

This is contradicted to the fact that p and q are co-prime numbers.

Therefore, our assumption is wrong.

Hence $\sqrt{7}$ is an irrational number.

28. Prove that: $(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = 7 + \tan^2 A + \cot^2 A$

NCERT Exercise 8.5 Q5 (viii) p-194

29. Find the median of the given distribution:

Class Interval	130 – 139	140 – 149	150 – 159	160 – 169	170 – 179	180 – 189	190 – 199
Frequency	4	9	18	28	24	10	7

Making given distribution continuous by subtracting $\frac{1}{2} = 0.5$ from lower limit and adding $\frac{1}{2} = 0.5$ to upper limit.

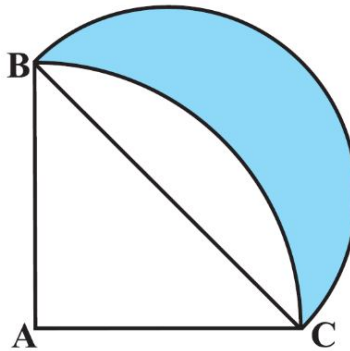
Class interval	f	c.f.
129.5 – 139.5	4	4
139.5 – 149.5	9	13
149.5 – 159.5	18	31
159.5 – 169.5	28	59
169.5 – 179.5	24	83
179.5 – 189.5	10	93
189.5 – 199.5	7	100

$$n = 100 \Rightarrow \frac{n}{2} = 50$$

Median class = 159.5 – 169.5, $l = 159.5$, $c.f. = 31$, $f = 28$, $h = 10$

$$\text{Median} = 159.5 + \left(\frac{50 - 31}{28} \right) \times 10 = 159.5 + \frac{19}{28} \times 10 = 166.285 = 166.3$$

30. In the below figure, ABC is a quadrant of a circle of radius 14 cm and a semicircle is drawn with BC as diameter. Find the area of the shaded region.



Ans: 98 cm²

NCERT Exercise 12.3 Q15 p-237

31. D and E are points on the sides CA and CB respectively of a triangle ABC right angled at C. Prove that $AE^2 + BD^2 = AB^2 + DE^2$.

NCERT Exercise 6.5 Q13 p-151

32. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears

- (i) a two-digit number
- (ii) a perfect square number.
- (iii) a number divisible by 5.

Ans: (i) $\frac{81}{90} = \frac{9}{10}$ (ii) $\frac{9}{90} = \frac{1}{10}$ (iii) $\frac{18}{90} = \frac{1}{5}$

OR

One card is drawn from a well shuffled deck of 52 cards. Find the probability of getting

- (i) a red face card.
- (ii) neither spade card nor face card
- (iii) an ace card.

Ans: (i) $\frac{6}{52} = \frac{3}{26}$ (ii) $\frac{30}{52} = \frac{15}{26}$ (iii) $\frac{4}{52} = \frac{1}{13}$

33. A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.

Ans: 40 km/hr

NCERT Exercise 4.3 Q8 p-88

OR

Sum of the areas of two squares is 468 m^2 . If the difference of their perimeters is 24 m , find the sides of the two squares.

Ans: The side of the first square is 12 m . and the side of the second square is 18 m .

NCERT Exercise 4.3 Q11 p-88

(Question no 34 to 36 are Long Answer Type questions of 5 marks each.)

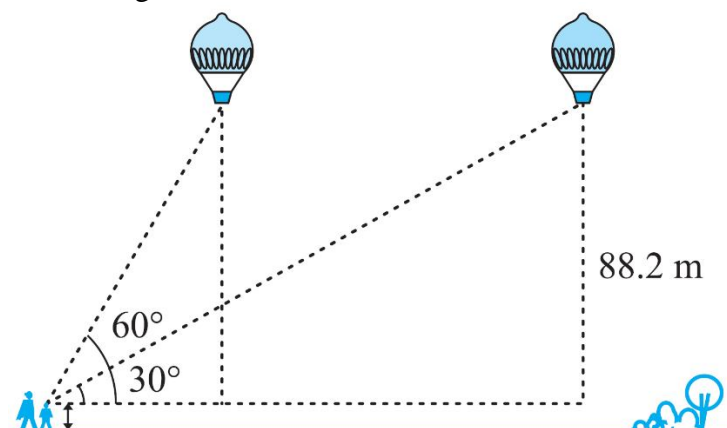
34. Draw the graphs of the equations $x - y + 1 = 0$ and $3x + 2y - 12 = 0$. Find the solution and determine the coordinates of the vertices of the triangle formed by these lines and the x-axis.

Ans: Solution is $x = 2, y = 3$;

Coordinates of the vertices of the triangle are $(2, 3), (-1, 0)$ and $(4, 0)$

NCERT Exercise 3.2 Q7 p-50

35. A 1.2 m tall girl spots a balloon moving with the wind in a horizontal line at a height of 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60° . After some time, the angle of elevation reduces to 30° (see below figure). Find the distance travelled by the balloon during the interval.



Ans: Distance travelled by the balloon during the interval = $58\sqrt{3} \text{ m}$

NCERT Exercise 9.1 Q14 p-205

OR

Two poles of equal heights are standing opposite each other on either side of the road, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60° and 30° , respectively. Find the height of the poles and the distances of the point from the poles.

Ans: Height of the pole = $20\sqrt{3}$ or 34.64 m

Distance of the point from the poles are 20 m and 60 m

NCERT Exercise 9.1 Q10 p-204

36. A container shaped like a right circular cylinder having diameter 12 cm and height 15 cm is full of ice cream. The ice cream is to be filled into cones of height 12 cm and diameter 6 cm , having a hemispherical shape on the top. Find the number of such cones which can be filled with ice cream.

Ans: Number of cones = 10

NCERT Exercise 13.3 Q5 p-251

