SOLUTION – MARCH 2024

Q. 1. (A) Choose the correct alternative from given :

(i) If 3 is one of the roots of the quadratic equation $kx^2 - 7x + 12 = 0$, then $k =$ ....

(A) 1 (B) -1 (C) 3 (D) -3

(ii) To draw the graph of $x + 2y = 4$, find x, when $y = 1$:

(A) 1 (B) 2 (C) -2 (D) 6

(iii) For an A.P., if $t_7 = 4$, $d = -4$, then $a =$ ....

(A) 6 (B) 7 (C) 20 (D) 28

(iv) In the format of GSTIN, there are .... alpha numerals.

(A) 9 (B) 10 (C) 15 (D) 16

Ans. (i) (A) (ii) (B) (iii) (D) (iv) (C).

Explanation : Only for guidance. Students are not expected to write this.

(i) Substitute $x = 3$ in the given quadratic equation.

(ii) Substitute $y = 1$ in the given equation.

(iii) Use the formula $t_n = a + (n-1)d$.

Q. 1. (B) Solve the following subquestions :

(i) If $17x + 15y = 11$ and $15x + 17y = 21$, then find the value of $x - y$.

Ans.

$17x + 15y = 11$ ... (1)

$15x + 17y = 21$ ... (2)

Subtracting equation (2) from equation (1),

$$\begin{array}{rcrcrl} 17x & + & 15y & = & 11 & \quad ...(1) \\ 15x & + & 17y & = & 21 & \quad ...(2) \\ - & & - & & - & \\ \hline 2x & - & 2y & = & -10 & \end{array}$$

Dividing both the sides by 2,

$x - y = \mathbf{-5}$.

(ii) Find first term of the sequence $t_n = 3n - 2$.

Ans.

$t_n = 3n - 2$

Substituting $n = 1$,

$t_1 = 3 \times 1 - 2$

$= 3 - 2 = 1$

The first term is **1**.

[**Note :** *In this Question Paper, few questions have options. However, here, the answers to all optional questions are given for the guidance of students.*]

(iii) The face value of a share is ₹100 and market value is ₹150. If the rate of brokerage is 2%, find the brokerage paid on one share.

Ans.

The rate of brokerage is 2%.

The market value of the share is ₹150.

The brokerage $= ₹\, 150 \times \frac{2}{100}$

$= ₹\, 3.$

The brokerage paid on one share is **₹3**.

(iv) Two-digit numbers are formed using digits 2, 3 and 5 without repeating a digit. Write the sample space.

Ans.

The sample space of two-digit numbers are formed using digits 2, 3 and 5 without repeating a digit.

S = {**23, 25, 32, 35, 52, 53**}.

Q. 2. (A) Complete the following activities and rewrite it :

(i) If (0, 2) is the solution of $2x+3y=k$, then complete the following activity to find the value of k :

Activity :

(0, 2) is the solution of the equation $2x+3y=k$.

Put $x=$ **0** and $y=$ **2** in the given equation.

$\therefore 2 \times \boxed{\mathbf{0}} + 3 \times 2 = k$

$\therefore 0+6=k$

$\therefore k = \boxed{\mathbf{6}}$

(ii) If 2 and 5 are the roots of the quadratic equation, then complete the following activity to form the quadratic equation :

Activity :

Let $\alpha=2$ and $\beta=5$ be the roots of the quadratic equation.

Then the quadratic equation is,

$x^2-(\alpha+\beta)x+\alpha\beta=0$

$\therefore x^2 - \left(2+\boxed{\mathbf{5}}\right)x + \boxed{\mathbf{2}} \times 5 = 0$

$\therefore x^2 - \boxed{\mathbf{7}}\, x + \boxed{\mathbf{10}} = 0$

(iii) Two coins are tossed simultaneously. Complete the following activity to write the sample space and the given events A and B in the set form :

Event A : To get at least one head.

Event B : To get no head.

[**Note :** *From here onwards, answers for activities are provided in bold. Students should consider rewriting the entire activity, including answers, during exams.*]

Activity :

Two coins are tossed simultaneously.

$\therefore$ sample space is

$S = \{\boxed{HH}, HT, TH, \boxed{TT}\}$

Event A : To get at least one head.

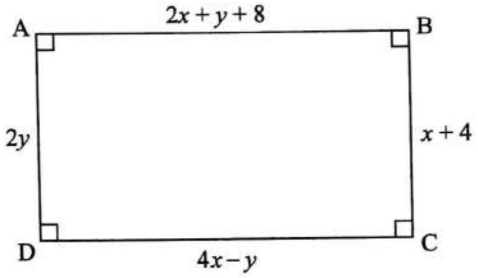
$\therefore A = \{\boxed{HH}, HT, TH\}$

Event B : To get no head.

$\therefore B = \{\boxed{TT}\}$

Q. 2. (B) Solve the following subquestions :

(i) $\square$ABCD is a rectangle. Write two simultaneous equations using information given below in the diagram, in the form of $ax+by=c$:



Solution :

$\square$ABCD is a rectangle.

$\therefore$ DC = AB ... (Opposite sides of a rectangle)

$\therefore 4x - y = 2x + y + 8$

$\therefore 4x - y - 2x - y = 8$

$\therefore 2x - 2y = 8$

$\therefore x - y = 4$ ... (Dividing both the sides by 2) ... (1)

Also, BC = AD ... (Opposite sides of a rectangle)

$\therefore x + 4 = 2y$

$\therefore x - 2y = -4$ ... (2)

Ans. The equations are $\mathbf{x - y = 4}$ and $\mathbf{x - 2y = -4}$.

(ii) Solve the following quadratic equation, using factorisation method :

$x^2 + x - 20 = 0$

Solution :

$x^2 + x - 20 = 0$

$\therefore x^2 + 5x - 4x - 20 = 0$

$\therefore x\,(x+5) - 4\,(x+5) = 0$

$\therefore (x+5)\,(x-4) = 0$

$\therefore x + 5 = 0$ or $x - 4 = 0$

$\therefore x = -5$ or $x = 4$

Ans. $\mathbf{-5}$ and $\mathbf{4}$ are the roots of the given quadratic equation.

(iii) Find the 19th term of the following A.P. :

7, 13, 19, 25, ...

Solution :

7, 13, 19, 25, ... is an A.P.

Here, $a = t_1 = 7$, $t_2 = 13$, $t_3 = 19$, $t_4 = 25$, ...

$d = t_2 - t_1 = 13 - 7 = 6.$

We have to find 19th term. $t_{19} = ?$

$t_n = a + (n-1)\ d$ ... (Formula)

$\therefore t_{19} = 7 + (19-1) \times 6$

$= 7 + 18 \times 6$

$= 7 + 108$

$\therefore t_{19} = 115$

Ans. The 19th term is **115**.

(iv) A card is drawn from a well shuffled pack of 52 playing cards. Find the probability that the card drawn is a face card.

Solution :

S is the sample space.

$\therefore n(S) = 52.$

Let event A : A card drawn is a face card.

Total face cards = 12

$\therefore n(A) = 12$

$$P(A) = \frac{n(A)}{n(S)} \quad \text{... (Formula)}$$

$$\therefore P(A) = \frac{12}{52}$$

$$\therefore P(A) = \frac{3}{13}$$

Ans. The probability is $\mathbf{\frac{3}{13}}$.

(v) The following table shows the classification of number of workers and number of hours they work in software company. Prepare less than upper limit type cumulative frequency distribution table.

Ans.

Daily number of hours	**Number of workers**	**Cumulative frequency less than upper limit type**
8–10	150	**150**
10–12	500	**650**
12–14	300	**950**
14–16	50	**1000**

Q. 3. (A) Complete the following activity and rewrite it :

(i) The following frequency distribution table shows the classification of the number of vehicles and the volume of petrol filled in them. Complete the following activity, to find the mode of the volume of petrol filled :

Class (Petrol filled in litres)	**Frequency (Number of vehicles)**
0.5–3.5	33
3.5–6.5	40
6.5–9.5	27
9.5–12.5	18
12.5–15.5	12

Activity :

From the given table, [the maximum frequency (40) is in the class 3.5 – 6.5 ...]

Modal class = $\boxed{\mathbf{3.5-6.5}}$

$$\text{Mode} = \boxed{L} + \left[\frac{f_1 - f_0}{2f_1 - f_0 - \boxed{f_2}}\right] \times h$$

$$\therefore \text{mode} = 3.5 + \left[\frac{40-33}{2(40)-33-27}\right] \times \boxed{3}$$

$$\therefore \text{mode} = 3.5 + \left[\frac{7}{80-60}\right] \times 3$$

$$\therefore \text{mode} = \boxed{4.55}$$

$\therefore$ the mode of the volume of petrol filled is $\boxed{\textbf{4.55 litres}}$.

(ii) The total value (with GST) of a remote controlled toy car is ₹2360. The rate of GST is 18% on toys. Complete the following activity to find the taxable value for the toy car :

Activity :

Total value for toy car with GST = ₹2360

The rate of GST = 18%

Let taxable value for toy car be ₹x.

$$\therefore \text{GST} = \frac{18}{100} \times x$$

$$\therefore \text{Total value for toy car} = \begin{pmatrix}\text{taxable value} \\ \text{for toy car}\end{pmatrix} + \boxed{\text{GST}} \quad \text{... (Formula)}$$

$$\therefore 2360 = \boxed{x} + \frac{\boxed{18}}{100} \times x$$

$$\therefore 2360 = \frac{\boxed{118}}{100} \times x$$

$$\therefore 2360 \times 100 = 118x$$

$$\therefore x = \frac{2360 \times 100}{\boxed{118}}$$

$\therefore$ taxable value for toy car is ₹ $\boxed{\mathbf{2000}}$.

Q. 3. (B) Solve the following subquestions :

(i) Solve the following quadratic equation by formula method :
$3m^2-m-10=0$

Solution :

$3m^2-m-10=0$

Comparing with the standard form $ax^2+bx+c=0$,
we get, $a=3,\ b=-1,\ c=-10$.

$b^2-4ac=(-1)^2-4\times3\times(-10)$

$=1+120$

$\therefore b^2-4ac=121$

$m=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ ... (Formula

$\therefore m=\dfrac{-(-1)\pm\sqrt{121}}{2\times3}$

$\therefore m=\dfrac{1+11}{6}$ or $m=\dfrac{1-11}{6}$

$\therefore m=\dfrac{12}{6}$ or $m=\dfrac{-10}{6}$

$\therefore m=2$ or $m=\dfrac{-5}{3}$

Ans. 2 and $\mathbf{\dfrac{-5}{3}}$ are the roots of the given quadratic equation.

(ii) Solve the following simultaneous equations using Cramer's rule :
$3x-4y=10,\ 4x+3y=5$

Solution :

$3x-4y=10$ ... (1) Here, $a_1=3,\ b_1=-4,\ c_1=10$

$4x+3y=5$ ... (2) $a_2=4,\ b_2=3,\ c_2=5$

$D=\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}=\begin{vmatrix} 3 & -4 \\ 4 & 3 \end{vmatrix}=3\times3-(-4)\times4=9+16=25$

$\therefore D=25$

$D_x=\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}=\begin{vmatrix} 10 & -4 \\ 5 & 3 \end{vmatrix}=10\times3-(-4)\times5=30+20=50$

$\therefore D_x=50$

$D_y=\begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}=\begin{vmatrix} 3 & 10 \\ 4 & 5 \end{vmatrix}=3\times5-10\times4=15-40=-25$

$\therefore D_y=-25$

Using Cramer's rule,

$x=\dfrac{D_x}{D};\ y=\dfrac{D_y}{D}$

$\therefore x=\dfrac{50}{25};\ y=\dfrac{-25}{25}$

$\therefore x=2;\ y=-1$

Ans. $(x,\ y)=\mathbf{(2,\ -1)}$ is the solution.

(iii) 50 shares of face value ₹10 were purchased for market value of ₹25. Company declared 30% dividend on the shares, then find :

(a) Sum invested (b) Dividend received (c) Rate of return

Solution :

FV = ₹10; MV = ₹25

Number of shares = 50

(a) Sum invested = MV × Number of shares

= ₹25 × 50

= ₹1250

(b) Dividend per share = 30% of FV

$= \frac{30}{100} \times 10$

= ₹3

Total dividend received on 50 shares = ₹3 × 50 = ₹150

(c) Rate of return $= \frac{\text{Dividend received}}{\text{Sum invested}} \times 100$

$= \frac{150}{1250} \times 100$

$= 12\%$

Ans. (a) Sum invested is **₹1250**.

(b) Dividend received is **₹150**.

(c) Rate of return is **12%**.

(iv) One coin and a die are thrown simultaneously. Find the probability of the following events :

Event A : To get a head and a prime number.

Event B : To get a tail and an odd number.

Solution :

One coin and a die are thrown simultaneously.

$\therefore$ sample space is S = {H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6}

$\therefore n(S) = 12$

Event A : To get a head and a prime number.

$\therefore A = \{H2, H3, H5\}$

$\therefore n(A) = 3$

$P(A) = \frac{n(A)}{n(S)}$ $\quad \therefore P(A) = \frac{3}{12} = \frac{1}{4}$

Event B : To get a tail and an odd number.

$\therefore B = \{T1, T3, T5\}$

$\therefore n(B) = 3$

$P(B) = \frac{n(B)}{n(S)}$ $\quad \therefore P(B) = \frac{3}{12} = \frac{1}{4}$

Ans. The probability of event A is $\mathbf{\frac{1}{4}}$ and the probability of event B is $\mathbf{\frac{1}{4}}$.

Q. 4. Solve the following subquestions :

(i) A tank can be filled up by two taps in 6 hours. The smaller tap alone takes 5 hours more than the bigger tap alone. Find the time required by each tap to fill the tank separately.

Solution :

Let the bigger tap alone fill the tank in x hours. Then the smaller tap alone fills the tank in $(x+5)$ hours.

In one hour, the bigger tap will fill $\frac{1}{x}$ part of the tank and the smaller tap will fill $\frac{1}{x+5}$ part of the tank.

$\therefore$ both the taps together will fill $\left(\frac{1}{x}+\frac{1}{x+5}\right)$ part of the tank.

The tank is filled up by two taps in 6 hours.

$\therefore$ both the taps together fill $\frac{1}{6}$ part of the tank in 1 hour.

$\therefore \frac{1}{x}+\frac{1}{x+5}=\frac{1}{6}$

$\therefore \frac{x+5+x}{x(x+5)}=\frac{1}{6}$

$\therefore \frac{2x+5}{x^2+5x}=\frac{1}{6}$

$\therefore 6(2x+5)=x^2+5x$

$\therefore x^2+5x=6(2x+5)$

$\therefore x^2+5x=12x+30$

$\therefore x^2+5x-12x-30=0$

$\therefore x^2-7x-30=0$

$\therefore x^2-10x+3x-30=0$

$\therefore x(x-10)+3(x-10)=0$

$\therefore (x-10)\ (x+3)=0$

$\therefore x-10=0$ or $x+3=0$

$\therefore x=10 \quad$ or $x=-3$

But the time cannot be negative.

$\therefore x=-3$ is unacceptable.

$\therefore x=10$ and $x+5=10+5=15$

Ans. The bigger tap alone fills the tank in **10 hours** and the smaller tap alone fills the tank in **15 hours**.

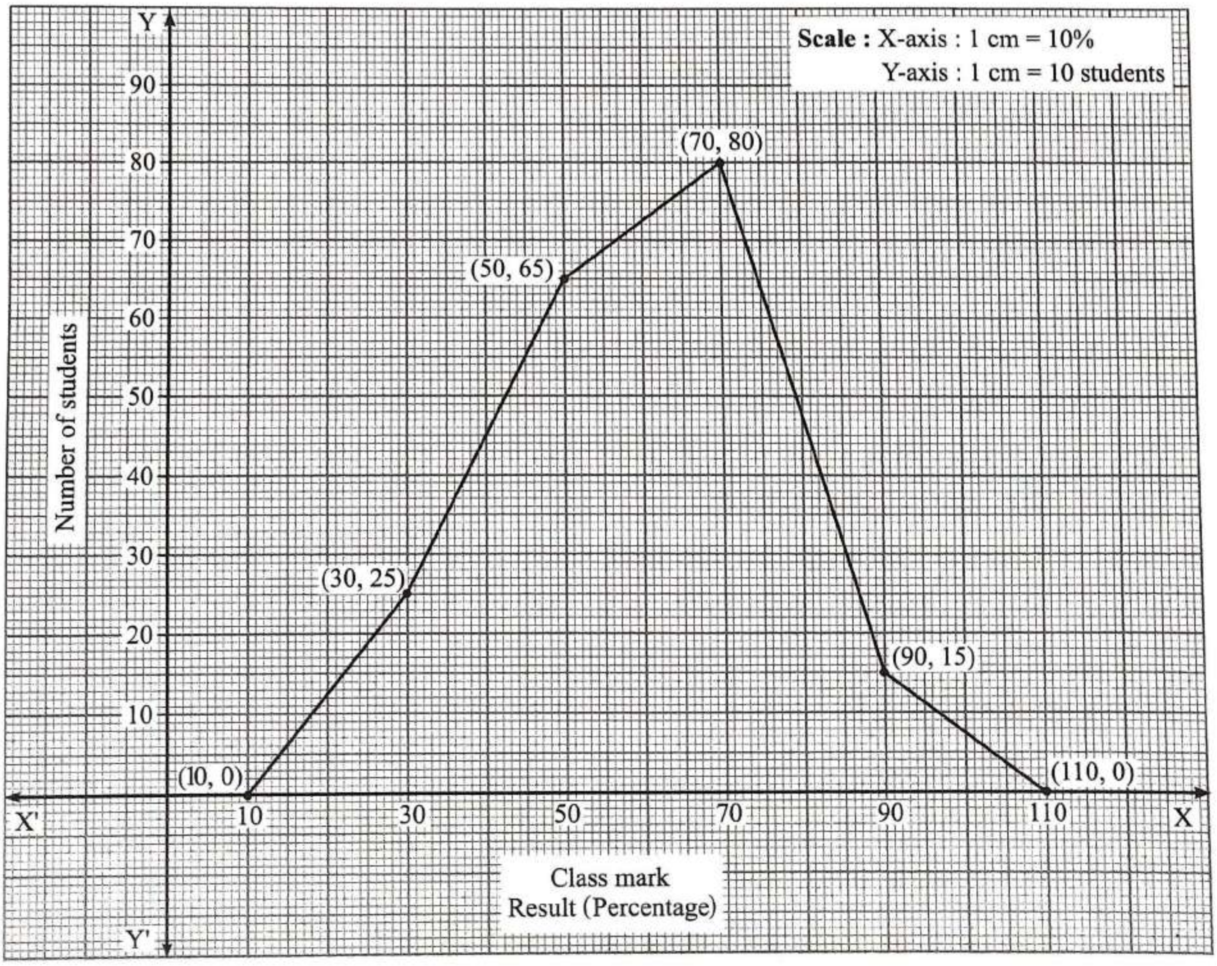
(ii) The following table shows that classification of percentage of marks of students and the number of students. Draw frequency polygon from that table without drawing histogram :

Result (Percentage)	Number of Students
20 – 40	25
40 – 60	65
60 – 80	80
80 – 100	15

Solution :

To draw the frequency polygon, we take two more classes. The class preceding the first class and the class succeeding the last class, each with frequency zero. The table to draw the frequency polygon is as follow :

Class result (percentage)	Class mark	Frequency (Number of students)	Coordinates of the points
0 – 20	10	0	(10, 0)
20 – 40	30	25	(30, 25)
40 – 60	50	65	(50, 65)
60 – 80	70	80	(70, 80)
80 – 100	90	15	(90, 15)
100 – 120	110	0	(110, 0)



(iii) In a 'Mahila Bachat Gat', Kavita invested ₹20 on the first day of month, ₹40 on the second day and ₹60 on the third day. If she saves like this, then what would be her total saving in the month of February 2020?

Solution :

Investment by Kavita on the 1st day of the month is ₹20, on the 2nd day ₹40, on the 3rd day ₹60 and so on. This is a sequence with common difference $d=20$.

$\therefore$ this is an A.P.

Here, $a=20$, $d=20$.

2020 is a leap year. $\therefore$ in the month of February 2020, there are 29 days.

$\therefore n=29$

We want to find S_{29}.

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

$\therefore S_{29}=\frac{29}{2}[2\times20+(29-1)\times20]$ ... (Substituting the values)

$=\frac{29}{2}[40+28\times20]$

$=\frac{29}{2}[40+560]$

$=\frac{29}{2}\times600=29\times300$

$\therefore S_{29}=8700$

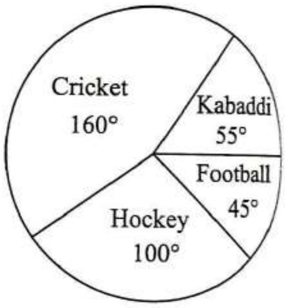
Ans. Total savings by Kavita in the month of February 2020 is ₹**8700**.

Q. 5. Solve the following subquestions :

(i) In the given figure, the pie diagram represents the amount spent on different sports by a school administration in a year. If the money spent on football is ₹9000, answer the following questions :

(a) What is the total amount spent on sports?

(b) What is the amount spent on cricket?



Solution :

(a) Let the total amount spent on sports be ₹x. The total amount corresponds to the central angle 360°.

The central angle for football $=\frac{\text{expenditure on football}}{\text{total expenditure}}\times360°$

$\therefore 45°=\frac{9000}{x}\times360°$

$\therefore x=\frac{9000\times360°}{45°}$

$\therefore x=72000$

The total amount spent on sports is ₹72,000.

(b) The central angle for cricket is 160°.

The central angle for cricket $=\frac{\text{expenditure on cricket}}{\text{total expenditure}}\times360°$

$\therefore 160° = \frac{\text{expenditure on cricket}}{72000} \times 360°$

$\therefore$ expenditure on cricket $= \frac{72000 \times 160°}{360°}$

$= 32000$

The amount spent on cricket is ₹32,000.

Ans. (a) ₹**72,000** (b) ₹**32,000**.

(ii) Draw the graph of the equation $x + y = 4$ and answer the following questions :

(a) Which type of triangle is formed by the line with X and Y-axes based on its sides.

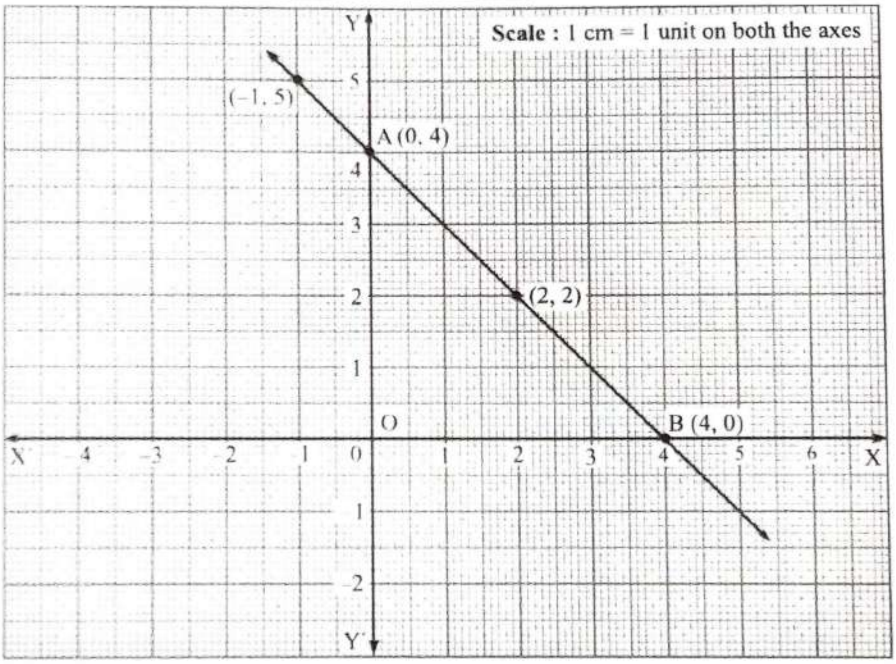
(b) Find the area of that triangle.

Solution :

$x + y = 4$

$\therefore y = 4 - x$

x	-1	0	2	4
y	5	4	2	0
(x, y)	$(-1, 5)$	$(0, 4)$	$(2, 2)$	$(4, 0)$



(a) $\triangle AOB$ is formed by the line with the X and Y-axes.

$\triangle AOB$ is an isosceles triangle.

[OA = 4 units, OB = 4 units.]

(b) $A(\triangle AOB) = \frac{1}{2} \times \text{base} \times \text{height}$ ... (Formula)

$= \frac{1}{2} \times OB \times OA$

$= \frac{1}{2} \times 4 \times 4 = 8$ sq units.

Ans. (a) The triangle formed is an **isosceles triangle**.

(b) The area of the triangle is **8 sq units**.

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