ICSE Solved Paper 2022 Semester-1 Mathematics

Class-X

(Maximum Marks : 40)

(Time allowed : One hours and a half)

All questions are compulsory.
The marks intended for questions are given in brackets [ ].
Select the correct option for each of the following questions.

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1. If $(x + 2)$ is a factor of the polynomial $x^3 - kx^2 - 5x + 6$ then the value of k is [1]
   (a) 1
   (b) 2
   (c) 3
   (d) –2

Ans. Option (b) is correct.

Explanation:
$$x + 2 = 0$$
$$x = -2$$
$$p(x) = x^3 - kx^2 - 5x + 6 = 0$$
Remainder $= p(-2) = 0$
$$(-2)^3 - k(-2)^2 - 5(-2) + 6 = 0$$
$$-8 - 4k + 10 + 6 = 0$$
$$-4k = -8$$
$$k = 2$$

2. The solution set of the inequation $x - 3 \geq -5, x \in R$ is [1]
   (a) $\{x : x > -2, x \in R\}$
   (b) $\{x : x \leq -2, x \in R\}$
   (c) $\{x : x \geq -2, x \in R\}$
   (d) $\{-2, -1, 0, 1, 2\}$

Ans. Option (c) is correct.

Explanation: $x - 3 \geq -5$
$$x \geq -5 + 3$$
$$x \geq -2$$

3. The product AB of two matrices A and B is possible if [1]
   (a) A and B have the same number of rows.
   (b) the number of columns of A is equal to the number of rows of B.
   (c) the number of rows of A is equal to the number of columns of B.
   (d) A and B have the same number of columns.

Ans. Option (b) is correct.

Explanation: The product of AB of two matrices A and B is possible if the number of column in A is equal to the number of rows in B.

4. If 70, 75, 80, 85 are the first four terms of an Arithmetic Progression, then the 10th term is [1]
   (a) 35
   (b) 25
   (c) 115
   (d) 105

Ans. Option (c) is correct.

Explanation: $a = 70, d = 75 - 70 = 5$
$$a_n = a + (n-1)d$$
$$a_{10} = 70 + (10-1)5$$
$$= 70 + 45$$
$$a_{10} = 115$$

5. The selling price of a shirt excluding GST is ₹ 800. If the rate of GST is 12% then the total price of the shirt is [1]
   (a) ₹704
   (b) ₹96
   (c) ₹896
   (d) ₹848

Ans. Option (c) is correct.

Explanation: SP = ₹ 800, GST = 12%
$$\text{GST} = ₹ \frac{12}{100} \times 800 = ₹ 96$$
Total Cost $= 800 + 96 = ₹ 896$

6. Which of the following quadratic equations has 2 and 3 as its roots? [1]
   (a) $x^2 - 5x + 6 = 0$
   (b) $x^2 + 5x + 6 = 0$
   (c) $x^2 - 5x - 6 = 0$
   (d) $x^2 + 5x - 6 = 0$

Ans. Option (a) is correct.

Explanation:
∵ $x^2 - (\text{sum of roots})x - (\text{product of roots}) = 0$
∴ $x^2 - (2 + 3)x - (2 \times 3) = 0$
⇒ $x^2 - 5x + 6 = 0$

7. If $x, 5.4, 5, 9$ are in proportion then x is [1]
   (a) 3
   (b) 9.72
   (c) 25
   (d) 25/3

Ans. Option (a) is correct.

Explanation: Numbers are in proportion (given)
⇒ $\dfrac{x}{5.4} = \dfrac{5}{9}$
⇒ $9 \times x = 5.4 \times 5$
⇒ $x = \dfrac{5.4 \times 5}{9} = 0.6 \times 5$
⇒ $x = 3$

8. Mohit opened a Recurring deposit account in a bank for 2 years. He deposits ₹1000 every month and receives ₹25500 on maturity. The interest he earned in 2 years is [1]
   (a) ₹13500
   (b) ₹3000
   (c) ₹24000
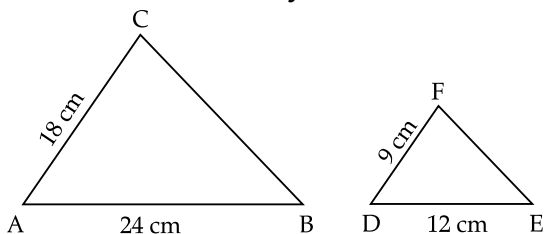   (d) ₹1500

Ans. Option (d) is correct.

Explanation:

Maturity Amount $= ₹25500$

Total deposit $= 1000 × 24 = ₹24000$

$\therefore$ Interest $= ₹25,500 – ₹24,000$

$= ₹1,500$
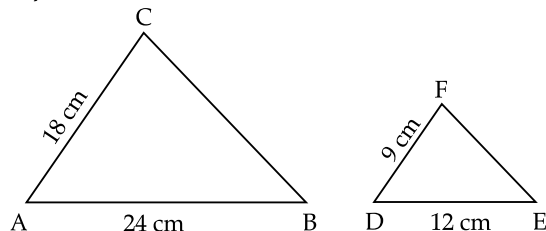
9. **In the given figure $AB = 24$ cm, $AC = 18$ cm, $DE = 12$ cm, $DF = 9$ cm and $\angle BAC = \angle EDF$. Then $\Delta ABC \sim \Delta DEF$ by the condition** [1]

(a) *AAA* (b) *SAS*

(c) *SSS* (d) *AAS*

Ans. Option (b) is correct.

Explanation: In ΔDEF & ΔABC,

$$\frac{AC}{DF} = \frac{AB}{DE} = \frac{2}{1}$$

$$\angle BAC = \angle EDF$$

Hence, $\Delta ABC \sim \Delta DEF$ (by *SAS* criterion)

10. **If $A = \begin{bmatrix} 5 & 10 \\ 3 & -4 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then AI is equal to** [1]

(a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 5 & 10 \\ -3 & 4 \end{bmatrix}$

(c) $\begin{bmatrix} 5 & 10 \\ 3 & -4 \end{bmatrix}$ (d) $\begin{bmatrix} 15 & 15 \\ -1 & -1 \end{bmatrix}$

Ans. Option (c) is correct.

Explanation: $A \times I = A$

11. **The polynomial $x^3 – 2x^2 + ax + 12$ when divided by $(x + 1)$ leaves, remainder 20, then 'a' is equal to** [1]

(a) $–31$ (b) 9

(c) 11 (d) $– 11$

Ans. Option (d) is correct.

Explanation: $x + 1 = 0$

$x = -1$

Remainder $= p(-1)$

Let $p(x) = x^3 – 2x^2 + ax + 12$

Now, $p(-1) = 20$

$\Rightarrow \quad (-1)^3 – 2(-1)^2 + a(-1) + 12 = 20$

$\Rightarrow \quad -1 – 2 – a + 12 = 20$

$\Rightarrow \quad -a = 20 – 9$

$\Rightarrow \quad a = -11$

12. **In an Arithmetic Progression (A.P.) if first term is 5, common difference is – 3 and the nth term is – 7, then n is equal to** [1]

(a) 5 (b) 17

(c) -13 (d) 7

Ans. Option (a) is correct.

Explanation: Given, $a = 5$, $d = -3$ and $a_n = -7$

Since, $a_n = a + (n-1)d$
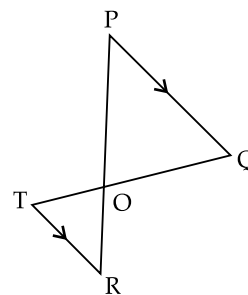
$\therefore \quad -7 = 5 + (n-1)(-3)$

$\Rightarrow \quad -7 - 5 = -3n + 3$

$\Rightarrow \quad -12 - 3 = -3n$

$\Rightarrow \quad -15 = -3n$

$\Rightarrow \quad n = 5$

13. **In the given figure PQ is parallel to TR, then by using condition of similarity** [1]
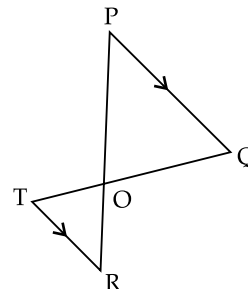

(a) $\dfrac{PQ}{RT} = \dfrac{OP}{OT} = \dfrac{OQ}{OR}$ (b) $\dfrac{PQ}{RT} = \dfrac{OP}{OR} = \dfrac{OQ}{OT}$

(c) $\dfrac{PQ}{RT} = \dfrac{OR}{OP} = \dfrac{OQ}{OT}$ (d) $\dfrac{PQ}{RT} = \dfrac{OP}{OR} = \dfrac{OT}{OQ}$

Ans. Option (b) is correct.

Explanation:

$PQ || TR$, PR is transversal,

$\Rightarrow \quad \angle P = \angle R$ (alternate angles)

Also, QT is transversal,

$\Rightarrow \quad \angle Q = \angle T$ (alternate angles)

$\therefore \quad \Delta RTO \sim \Delta PQO$ (by AA criterion)

$$\therefore \qquad \frac{PQ}{RT} = \frac{PO}{RO} = \frac{QO}{TO} \qquad \text{(by C.P. C.T.)}$$

14. If $a, b, c,$ and d are proportional then $\frac{a+b}{a-b}$ is equal to **[1]**

(a) $\frac{c}{d}$ (b) $\frac{c-d}{c+d}$

(c) $\frac{d}{c}$ (d) $\frac{c+d}{c-d}$

Ans. **Option (d) is correct.**

Explanation:

Given, $\qquad\qquad \frac{a}{b} = \frac{c}{d}$

By compodendo-dividendo

$$\frac{a+b}{a-b} = \frac{c+d}{c-d}$$

15. The first four terms of an Arithmetic Progression (A. P.), whose first term is 4 and common difference is -6, are **[1]**
(a) $4, -10, -16, -22$ (b) $4, 10, 16, 22$
(c) $4, -2, -8, -14$ (d) $4, 2, 8, 14$

Ans. **Option (c) is correct.**
Explanation: $a = 4$; $d = -6$
First four terms of an A.P. are:

$$a, a+d, a+2d, a+3d$$
$$\Rightarrow \qquad 4, 4+(-6), 4+2(-6), 4+3(-6)$$
$$\Rightarrow \qquad 4, -2, -8, -14$$

16. One of the roots of the quadratic equation $x^2 - 8x + 5 = 0$ is 7.3166. The root of the equation correct to 4 significant figures is **[1]**
(a) 7.3166   (b) 7.317
(c) 7.316   (d) 7.32

Ans. **Option (b) is correct.**
Explanation: Correct to 4 significant figures is 7.317.

17. $(x + 2)$ and $(x + 3)$ are two factors of the polynomial $x^3 + 6x^2 + 11x + 6$. If this polynomial is completely factorised the result is **[2]**
(a) $(x-2)(x+3)(x+1)$ (b) $(x+2)(x-3)(x-1)$
(c) $(x+2)(x+3)(x-1)$ (d) $(x+2)(x+3)(x+1)$

Ans. **Option (d) is correct.**
Explanation:
Let $\qquad p(x) = x^3 + 6x^2 + 11x + 6$
If $\qquad\quad x + 1 = 0$
then $\qquad\qquad x = -1$
Now, $\qquad p(-1) = (-1)^3 + 6(-1)^2 + 11(-1) + 6$
$$\qquad\qquad\qquad = -1 + 6 - 11 + 6 = 0$$
Hence, $(x + 1)$ is a third factor.

18. The sum of the first 20 terms of the Arithmetic Progression 2, 4, 6, 8, ... is **[2]**
(a) 400   (b) 840
(c) 420   (d) 800

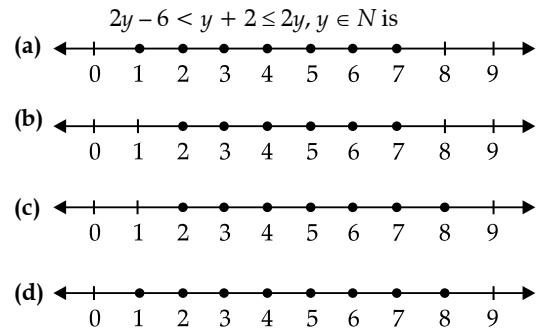**Ans.** **Option (c) is correct.**

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

Here, $a = 2, d = 4 - 2 = 2$ and $n = 20$

$$\therefore \qquad\qquad S_{20} = \frac{20}{2}[2 \times 2 + (20-1)2]$$
$$= 10[4 + 38]$$
$$= 10 \times 42 = 420$$

19. The solution set on the number line of the linear inequation **[2]**
$$2y - 6 < y + 2 \le 2y, y \in N \text{ is}$$

(a)

(b)

(c)

(d)

Ans. **Option (b) is correct.**
Explanation: $\quad 2y - 6 < y + 2$
$$2y - y < 2 + 6$$
$$y < 8$$
and, $\qquad\qquad y + 2 \le 2y$
$$2 \le 2y - y$$
$$2 \le y$$
So, $\qquad\qquad 2 \le y < 8$

20. If x, y, z are in continued proportion then $(y^2 + z^2)$: $(x^2 + y^2)$ is equal to **[2]**
(a) $z : x$ (b) $x : z$
(c) zx (d) $(y + z) : (x + y)$

Ans. **Option (a) is correct.**
Explanation: x, y, z are in proportion
$$y^2 = xz$$
$$\therefore \quad \frac{y^2 + z^2}{x^2 + y^2} = \frac{xz + z^2}{x^2 + xz} = \frac{z(x+z)}{x(x+z)} = \frac{z}{x}$$
i.e., $\qquad\qquad z : x$

21. The marked price of an article is ₹ 5000. The shopkeeper gives a discount of 10%. If the rate of GST is 12%, then the amount paid by the customer including GST is **[2]**
(a) ₹5040   (b) ₹6100
(c) ₹6272   (d) ₹6160

Ans. **Option (a) is correct.**
Explanation: SP $=$ MP $-$ Discount
$$= 5000 - \frac{10}{100} \times 5000$$
$$= 5000 - 500 = 4500$$
GST $= 12\%$

$$\text{GST amount} = \frac{12}{100} \times 4500 = 540$$

Total amount paid = 4500 + 540 = ₹5040

22. If $A = \begin{bmatrix} 3 & 5 \\ 1 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 4 \\ 0 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix}$, then

5A – BC is equal to **[2]**

(a) $\begin{bmatrix} -5 & -23 \\ 1 & 17 \end{bmatrix}$ (b) $\begin{bmatrix} 5 & 23 \\ 1 & 17 \end{bmatrix}$

(c) $\begin{bmatrix} -2 & 8 \\ -3 & 3 \end{bmatrix}$ (d) $\begin{bmatrix} 5 & 23 \\ -1 & 17 \end{bmatrix}$

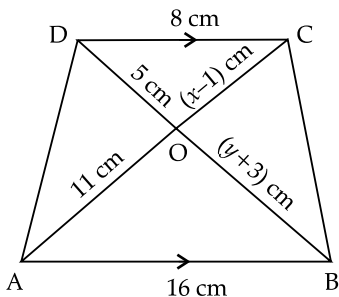**Ans. Option (d) is correct.**

Explanation:

$$5A - BC = 5\begin{bmatrix} 3 & 5 \\ 1 & 4 \end{bmatrix} - \begin{bmatrix} 2 & 4 \\ 0 & 3 \end{bmatrix}\begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 15 & 25 \\ 5 & 20 \end{bmatrix} - \begin{bmatrix} 10 & 2 \\ 6 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 5 & 23 \\ -1 & 17 \end{bmatrix}$$

23. In the given figure ABCD is a trapezium in which DC is parallel to AB.

AB = 16 cm and DC = 8 cm, OD = 5 cm,

OB = (y +3) cm, OA = 11 cm and OC = (x – 1) cm.

Using the given information answer the following questions.

(i) From the given figure name the pair of similar triangles **[1]**

(a) $\Delta OAB, \Delta OBC$ (b) $\Delta COD, \Delta AOB$

(c) $\Delta ADB, \Delta ACB$ (d) $\Delta COD, \Delta COB$

(ii) The corresponding proportional sides with respect to the pair of similar triangles obtained in (i) **[1]**

(a) $\dfrac{CD}{AB} = \dfrac{OC}{OA} = \dfrac{OD}{OB}$

(b) $\dfrac{AD}{BC} = \dfrac{OC}{OA} = \dfrac{OD}{OB}$

(c) $\dfrac{AD}{BC} = \dfrac{BD}{AC} = \dfrac{AB}{DC}$

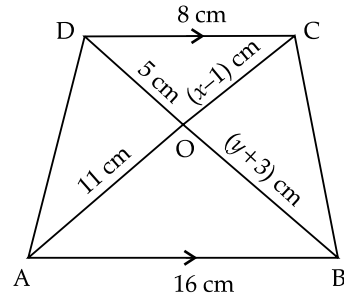(d) $\dfrac{OD}{OB} = \dfrac{CD}{CB} = \dfrac{OC}{OA}$

(iii) The ratio of the sides of the pair of similar triangles is **[1]**

(a) 1 : 3   (b) 1 : 2

(c) 2 : 3   (d) 3 : 1

(iv) Using the ratio of sides of the pair of similar triangles the values of x and y are respectively **[1]**

(a) $x = 4.6, y = 7$ (b) $x = 7, y = 7$

(c) $x = 6.5, y = 7$ (d) $x = 6.5, y = 2$

Ans.

(i) **Option (b) is correct.**

Explanation: $DC \parallel AB$ (given)

$\angle CDO = \angle ABO$ (alternate angle)

$\angle DCO = \angle BAO$ (alternate angle)

∴ $\Delta COD \sim \Delta AOB$ (by AA criterion)

(ii) **Option (a) is correct.**

Explanation:

$\Delta COD \sim \Delta AOB$

∴ $\dfrac{CD}{AB} = \dfrac{OD}{OB} = \dfrac{CO}{AO}$ (by C.P. C.T.)

(iii) **Option (b) is correct.**

Explanation:

$$\frac{CD}{AB} = \frac{OD}{OB} = \frac{CO}{AO} = \frac{8}{16} = \frac{1}{2}$$

(iv) **Option (c) is correct.**

Explanation:

Here, $\dfrac{x-1}{11} = \dfrac{5}{y+3} = \dfrac{1}{2}$

∴ $\dfrac{x-1}{11} = \dfrac{1}{2}$ and $\dfrac{5}{y+3} = \dfrac{1}{2}$

$\Rightarrow 2x - 2 = 11$ and $y + 3 = 10$

$\Rightarrow \quad x = \dfrac{13}{2} = 6.5$ and $y = 7$

24. Two cars X and Y use 1 litre of diesel to travel x km and $(x + 3)$ km respectively. If both the cars covered a distance of 72 km, then:

(i) The number of litres of diesel used by car X is **[1]**

(a) $\dfrac{72}{x-3}$ litres   (b) $\dfrac{72}{x+3}$ litres

(c) $\dfrac{72}{x}$ litres   (d) $\dfrac{12}{x}$ litres

(ii) **The number of litres of diesel used by car Y is** **[1]**

(a) $\dfrac{72}{x-3}$ litres   (b) $\dfrac{72}{x+3}$ litres

(c) $\dfrac{72}{x}$ litres   (d) $\dfrac{12}{x+3}$ litres

(iii) **If car X used 4 litres of diesel more than car Y in the journey, then** **[1]**

(a) $\dfrac{72}{x-3}-\dfrac{12}{x}=4$ (b) $\dfrac{72}{x+3}-\dfrac{72}{x}=4$

(c) $\dfrac{72}{x}-\dfrac{72}{x+3}=4$ (d) $\dfrac{72}{x-3}-\dfrac{72}{x+3}=4$

(iv) **The amount of diesel used by the car X is** **[1]**
  (a) 6 litres   (b) 12 litres
  (c) 18 litres   (d) 24 litres

Ans. **(i)** **Option (c) is correct.**
  Explanation: x km $= 1$ litre
  $$72\,\text{km} = \dfrac{72}{x}\ \text{litres}$$

(ii) **Option (b) is correct.**
  Explanation:
  $(x+3)$ km $= 1$ litre
  $$72\,\text{km} = \dfrac{72}{x+3}\ \text{litres}$$

(iii) **Option (c) is correct.**
  Explanation: Since, given car X used 4 litres of diesel more than car Y.
  Therefore, $\dfrac{72}{x}-\dfrac{72}{x+3}=4$

(iv) **Option (b) is correct.**
  Explanation: We have, $\dfrac{72}{x}-\dfrac{72}{x+3}=4$

  $\Rightarrow\quad 72(x+3)-72x = 4x^2+12x$
  $\Rightarrow\quad 72x+216-72x = 4x^2+12x$
  $\Rightarrow\quad 4x^2+12x-216 = 0$
  $\Rightarrow\quad x^2+3x-54 = 0$
  $\Rightarrow\quad x^2+9x-6x-54 = 0$
  $\Rightarrow\quad x(x+9)-6(x+9) = 0$
  $\Rightarrow\quad (x-6)(x+9) = 0$
  $\Rightarrow\quad x = 6$
  (distance cannot be –ve)

$\therefore$ Amount of diesel used by car X is $\dfrac{72}{6}=12$ litres

25. **Joseph has a recurring deposit account in a bank for two years at the rate of 8%per annum simple interest.**

(i) **If at the time of maturity Joseph receives ₹ 2000 as interest then the monthly installment is** **[1]**
  (a) ₹ 1200   (b) ₹ 600
  (c) ₹ 1000   (d) ₹ 1600

(ii) **The total amount deposited in the bank** **[1]**
  (a) ₹ 25000   (b) ₹ 24000
  (c) ₹ 26000   (d) ₹ 23000

(iii) **The amount Joseph receives on maturity is** **[1]**
  (a) ₹ 27000   (b) ₹ 25000
  (c) ₹ 26000   (d) ₹ 28000

(iv) **If the monthly installment is ₹ 100 and the rate of interest is 8%, in how many months Joseph will receive ₹ 52 as interest?** **[1]**
  (a) 18   (b) 30
  (c) 12   (d) 6

Ans. **(i)** **Option (c) is correct.**
  Explanation: Given, $R = 8\%$; $I = ₹\ 2000$, $n = 24$
  $$I = P \times \dfrac{n(n+1)}{2} \times \dfrac{R}{1200}$$
  $$2000 = P \times \dfrac{24 \times 25}{2} \times \dfrac{8}{1200}$$
  $$2000 = P \times 12 \times \dfrac{8}{48}$$
  $$P = \dfrac{2000}{2} = ₹1{,}000$$

(ii) **Option (b) is correct.**
  Explanation: Total amount $= ₹\ 1000 \times 24$
  $$= ₹\ 24{,}000$$

(iii) **Option (c) is correct.**
  Explanation:
  Maturity amount$=$ Total amount $+$ Interest
  $$= ₹\ 24000 + ₹\ 2000$$
  $$= ₹\ 26{,}000$$

(iv) **Option (c) is correct.**
  Explanation: $R = 8\%$; $I = ₹\ 52$, $P = ₹100$
  $$I = P \times \dfrac{n(n+1)}{2} \times \dfrac{R}{1200}$$
  $$52 = 100 \times \dfrac{n(n+1)}{2} \times \dfrac{8}{1200}$$
  $$n(n+1) = 3 \times 52$$

$$n^2 + n - 156 = 0$$
$$n^2 + 13n - 12n - 156 = 0$$
$$n(n + 13) - 12(n + 13) = 0$$

$$(n + 13)(n - 12) = 0$$
$$\therefore \qquad n = 12 \text{ months}$$

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