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.

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 = \(p(-2) = 0\)

\[(-2)^3 - k(-2)^2 - 5(-2) + 6 = 0\]

\[-8 - 4k + 10 + 6 = 0\]

\[-4k = -8\]

\[k = 2\]

5. The selling price of a shirt excluding GST is \(\text{₹} 800\) . If the rate of GST is 12% then the total price of the shirt is \(\text{₹} \) \[1\]

(a) ₹704  
(b) ₹96
(c) ₹896  
(d) ₹848

Ans. Option (c) is correct.

Explanation:
\[\text{SP} = \text{₹} 800, \text{GST} = 12\%\]

\[\text{GST} = \frac{12}{100} \times 800 = \text{₹} 96\]

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:
\[Q \times x^2 - \text{(sum of roots)} \times x - \text{(product of roots)} = 0\]

\[\therefore x^2 - (2 + 3)x - (2 \times 3) = 0\]

\[\Rightarrow x^2 - 5x + 6 = 0\]

7. If \(x, 5, 4, 5, 9\) are in proportion then \(x\) is \(\text{[1]}\)

(a) 3  
(b) 9.72
(c) 25  
(d) 25/3

Ans. Option (a) is correct.

Explanation:
Numbers are in proportion (given)

\[\Rightarrow \frac{x}{5.4} = \frac{5}{9}\]

\[\Rightarrow 9 \times x = 5.4 \times 5\]

\[\Rightarrow x = \frac{5.4 \times 5}{9} = 0.6 \times 5\]

\[\Rightarrow x = 3\]

8. Mohit opened a Recurring deposit account in a bank for 2 years. He deposits \(\text{₹} 1000\) every month and receives \(\text{₹} 25500\) on maturity. The interest he earned in 2 years is \(\text{[1]}\)

(a) ₹13500  
(b) ₹3000
(c) ₹24000  
(d) ₹1500
Ans. Option (d) is correct.

Explanation:

Maturity Amount = ₹25500
Total deposit = 1000 × 24 = ₹24000
∴ 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 ∠BAC = ∠EDF.
Then ΔABC ~ ΔDEF by the condition [1]

(a) AAA (b) SAS (c) SSS (d) AAS

Ans. Option (b) is correct.

Explanation: In ΔDEF & ΔABC,

\[ \frac{AC}{DF} = \frac{AB}{DE} = \frac{2}{1} \]

∠BAC = ∠EDF

Hence, ΔABC ~ ΔDEF (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) \( \begin{bmatrix} -1 & 5 \\ -1 & 15 \end{bmatrix} \)

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, \( p(-1) = 20 \)
\[ \Rightarrow (-1)^3 - 2(-1)^2 + a(-1) + 12 = 20 \]
\[ \Rightarrow -1 - 2 - a + 12 = 20 \]
\[ \Rightarrow -a = 20 - 9 \]
\[ \Rightarrow a = -11 \]

12. In an Arithmetic Progression (A.P.) if first term is 5, common difference is -3 and the \( n^{th} \) 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, 
\[ a_n = a + (n - 1)d \]
\[ \therefore -7 = 5 + (n-1)(-3) \]
\[ \Rightarrow -7 - 5 = -3n + 3 \]
\[ \Rightarrow -12 = -3n \]
\[ \Rightarrow -15 = -3n \]
\[ \Rightarrow n = 5 \]

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

(a) \( \frac{PQ}{RT} = \frac{OP}{OT} = \frac{OQ}{OR} \) (b) \( \frac{PQ}{RT} = \frac{OP}{OR} = \frac{OQ}{OT} \) (c) \( \frac{PQ}{RT} = \frac{OP}{OT} = \frac{OQ}{OR} \) (d) \( \frac{PQ}{RT} = \frac{OP}{OR} = \frac{OQ}{OT} \)

Ans. Option (b) is correct.

Explanation:

\( PQ \parallel TR, PR \) is transversal,

\[ \therefore \angle P = \angle R \quad \text{(alternate angles)} \]

Also, \( QT \) is transversal,
\[ \therefore \angle Q = \angle T \quad \text{(alternate angles)} \]
\[ \therefore \triangle RTO \sim \triangle PQO \quad \text{(by AA criterion)} \]
14. If \(a, b, c, \) and \(d\) are proportional then \(\frac{a+b}{a-b}\) is equal to \(\frac{c}{d}\) \[\text{[1]}\]

\(\text{Ans.}\) Option (d) is correct.

**Explanation:**
Given,
\[
\frac{a}{b} = \frac{c}{d}
\]
By componendo-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 \[\text{[1]}\]

(a) 4, –10, –10, –14 (b) 4, 10, 16, 22
(c) 4, –2, –8, –14 (d) 4, 2, 8, 14

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

**Explanation:** First four terms of an A.P. are:
\[
a, a + d, a + 2d, a + 3d
\]
\[
\Rightarrow 4, 4 + (-6), 4 + 2(-6), 4 + 3(-6)
\]
\[
\Rightarrow 4, -2, -8, -14
\]

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 \[\text{[1]}\]

(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 \[\text{[2]}\]

(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 \(p(x) = x^3 + 6x^2 + 11x + 6\)

\[
\begin{align*}
p(x) &= x^3 + 6x^2 + 11x + 6 \\
&= (x + 1)(x + 2)(x + 3)
\end{align*}
\]

Hence, \(x + 1\) is a third factor.

18. The sum of the first 20 terms of the Arithmetic Progression 2, 4, 6, 8, ........... is \[\text{[2]}\]

(a) 400 (b) 840 (c) 420 (d) 800

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

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

Here, \(a = 2, d = 4 - 2 = 2\) and \(n = 20\)
\[
\therefore S_{20} = \frac{20}{2} [2 \times 2 + (20 - 1)2] = 10[4 + 38] = 10 \times 42 = 420
\]

19. The solution set on the number line of the linear inequation \[\text{[2]}\]

\[
2y - 6 < y + 2 \leq 2y, y \in N
\]

(a) \(\mid\) 1 2 3 4 5 6 7 8 9 \(\mid\)
(b) \(\mid\) 0 1 2 3 4 5 6 7 8 9 \(\mid\)
(c) \(\mid\) 0 1 2 3 4 5 6 7 8 9 \(\mid\)
(d) \(\mid\) 0 1 2 3 4 5 6 7 8 9 \(\mid\)

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

**Explanation:**
\[
2y - 6 < y + 2 \leq 2y
\]
and,
\[
y + 2 \leq 2y - y
\]
\[
2 \leq y
\]
\[
\Rightarrow 2 \leq y < 8
\]

20. If \(x, y, z\) are in continued proportion then \((y^2 + z^2) : (x^2 + y^2)\) is equal to \[\text{[2]}\]

(a) \(z : x\) (b) \(x : z\) (c) \(zx\) (d) \((y + z) : (x + y)\)

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

**Explanation:**
\[
y^2 + z^2 = xz + z^2 = \frac{z(x + z)}{x}
\]
\[
\Rightarrow \frac{y^2 + z^2}{x^2 + y^2} = \frac{xz + z^2}{x^2 + xz} = \frac{z(x + z)}{x}
\]
i.e., \(z : x\)

21. The marked price of an article is \(\text{₹} 5000\). The shopkeeper gives a discount of 10%. If the rate of GST is 12%, then the amount paid by the customer including GST is \[\text{[2]}\]

(a) \(\text{₹} 5040\) (b) \(\text{₹} 6100\) (c) \(\text{₹} 6272\) (d) \(\text{₹} 6160\)

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

**Explanation:**
\[
\text{SP} = \text{MP} - \text{Discount} = 5000 - \frac{10}{100} \times 5000
\]
\[
= 5000 - 500 = 4500
\]
\[
\text{GST} = 12\%
\]
GST amount = \( \frac{12}{100} \times 4500 = 540 \)

Total amount paid = 4500 + 540 = ₹5040

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

5\(A - BC\) is equal to

(a) \( \begin{pmatrix} -5 & -23 \\ 1 & 17 \end{pmatrix} \)

(b) \( \begin{pmatrix} 5 & 23 \\ 1 & 17 \end{pmatrix} \)

(c) \( \begin{pmatrix} -2 & 8 \\ -3 & 3 \end{pmatrix} \)

(d) \( \begin{pmatrix} 5 & 23 \\ -1 & 17 \end{pmatrix} \)

Ans. Option (d) is correct.

Explanation:

\[
5A - BC = 5 \begin{pmatrix} 3 & 5 \\ 1 & 4 \end{pmatrix} - \begin{pmatrix} 2 & 4 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} 1 & -1 \\ 2 & 1 \end{pmatrix} = \begin{pmatrix} 15 & 25 \\ 5 & 20 \end{pmatrix} - \begin{pmatrix} 10 & 2 \\ 6 & 3 \end{pmatrix} = \begin{pmatrix} 5 & 23 \\ -1 & 17 \end{pmatrix}
\]

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) \( \triangle AOB, \triangle OBC \)

(b) \( \triangle COD, \triangle AOB \)

(c) \( \triangle ADB, \triangle ACB \)

(d) \( \triangle COD, \triangle COB \)

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

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

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

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

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

(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.

Option (b) is correct.

Explanation: \(\angle CDO = \angle ABO\) (given)
\(\angle DCO = \angle BAO\) (alternate angle)
\(\angle COD = \angle AOB\) (by AA criterion)

\(\frac{CD}{AB} = \frac{OD}{OB} = \frac{CO}{AO}\)

(i) Option (b) is correct.

Explanation: \(\angle CDO = \angle ABO\) (given)

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

\(\angle COD = \angle AOB\) (by AA criterion)

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

(ii) Option (a) 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, \(\frac{x - 1}{11} = \frac{5}{y + 3} = \frac{1}{2}\)

\(\therefore \frac{x - 1}{11} = \frac{5}{y + 3} = \frac{1}{2}\)

\(\Rightarrow 2x - 2 = 11\) and \(\frac{5}{y + 3} = \frac{1}{2}\)

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

\(\Rightarrow x = \frac{13}{2} = 6.5\) 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) \( \frac{72}{x-3} \) litres  \hspace{1cm} (b) \( \frac{72}{x+3} \) litres
(c) \( \frac{72}{x} \) litres  \hspace{1cm} (d) \( \frac{12}{x} \) litres

(ii) The number of litres of diesel used by car Y is
(a) \( \frac{72}{x-3} - 3 \) litres  \hspace{1cm} (b) \( \frac{72}{x+3} + 3 \) litres
(c) \( 72x \) litres  \hspace{1cm} (d) \( 12x + 3 \) litres

(ii) The number of litres of diesel used by car Y in the journey, then
(a) \( \frac{72}{x-3} \times 4 \) litres  \hspace{1cm} (b) \( \frac{72}{x+3} - \frac{72}{x} = 4 \)
(c) \( 72 \) litres  \hspace{1cm} (d) \( \frac{12}{x} \) litres

(iv) Option (b) is correct.
Explanation: We have, \( \frac{72}{x} - \frac{72}{x+3} = 4 \)
\[ \Rightarrow \quad 72(x+3) - 72x = 4x^2 + 12x \]
\[ \Rightarrow \quad 72x + 216 - 72x = 4x^2 + 12x \]
\[ \Rightarrow \quad 4x^2 + 12x - 216 = 0 \]
\[ \Rightarrow \quad x^2 + 3x - 54 = 0 \]
\[ \Rightarrow \quad x^2 + 9x - 6x - 54 = 0 \]
\[ \Rightarrow \quad x(x + 9) - 6(x + 9) = 0 \]
\[ \Rightarrow \quad (x-6)(x+9) = 0 \]
\[ \Rightarrow \quad x = 6 \]
(distance cannot be \(-ve\))

\( \therefore \) Amount of diesel used by car X is \( \frac{72}{6} = 12 \) 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 \( \text{₹} 2000 \) as interest then the monthly installment is
(a) \( \text{₹} 1200 \)  \hspace{1cm} (b) \( \text{₹} 600 \)
(c) \( \text{₹} 1000 \)  \hspace{1cm} (d) \( \text{₹} 1600 \)

(ii) The total amount deposited in the bank
(a) \( \text{₹} 25000 \)  \hspace{1cm} (b) \( \text{₹} 24000 \)
(c) \( \text{₹} 26000 \)  \hspace{1cm} (d) \( \text{₹} 23000 \)

(iii) The amount Joseph receives on maturity is
(a) \( \text{₹} 27000 \)  \hspace{1cm} (b) \( \text{₹} 25000 \)
(c) \( \text{₹} 26000 \)  \hspace{1cm} (d) \( \text{₹} 28000 \)

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

Ans. (i) Option (c) is correct.
Explanation: Given, \( R = 8\% \); \( I = \text{₹} 2000 \), \( n = 24 \)
\[ I = P \times \frac{n(n+1)}{2} \times \frac{R}{1200} \]
\[ 2000 = P \times \frac{24 \times 25}{2} \times \frac{8}{1200} \]
\[ 2000 = P \times 12 \times \frac{8}{48} \]
\[ P = \frac{2000}{2} = \text{₹} 1000 \]

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

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

(iv) Option (c) is correct.
Explanation: \( R = 8\% \); \( I = \text{₹} 52 \), \( P = \text{₹} 100 \)
\[ I = P \times \frac{n(n+1)}{2} \times \frac{R}{1200} \]
\[ 52 = 100 \times \frac{n(n+1)}{2} \times \frac{8}{1200} \]
\[ n(n + 1) = 3 \times 52 \]
\[ n^2 + n - 156 = 0 \]
\[ n^2 + 13n - 12n - 156 = 0 \]
\[ n(n + 13) - 12(n + 13) = 0 \]

\[ (n + 13)(n - 12) = 0 \]

\[ n = 12 \text{ months} \]