1. Answer: B

Given that

Ramesh buys five apples at a cost of Rs.10 each

The cost price of 5 apples = 5 \times 10 = Rs.50

He sells all apples to Ganesh at a profit of 10% = 110% of 50 = Rs.55

Therefore, selling price of each apple = \frac{55}{5} = 11

2. Answer: B

Given that

length \((l) = mn\), breadth \((b) = m^2 p\), depth \((d) = pmn^2\)

Volume of the rectangular box = l \times b \times d

= mn \times m^2 p \times pmn^2

= (m \times m^2 \times m) \times (n \times n^2) \times (p \times p)

If bases are equal then their powers are to be added, \(a^m \times a^n = a^{m+n}\)

= \(m^{1+2+1} \times n^{1+2} \times p^{1+1}\)

= \(m^4 n^3 p^2\)

3. Answer: B

\(F + V - E = 2\)

Where ‘F’ stands for number of faces,
‘V’ stands for number of vertices and
‘E’ stands for number of edges.

This relationship is called Euler’s formula

4. Answer: B

Given that,

Number of matches in a series \((N) = 5\)

Matches won by the India = 60% of \(N\)

= 60% of 5
\[
= \frac{60}{100} \times 5 = 3
\]

No of matches lost by India = \(N - (\text{Matches won by India})\)
\[= 5 - 3 = 2\]

5. Answer: A

Rewrite \(p = 2q + 6\) as \(p - 2q = 6\),

Taking the cube on both sides of \(p - 2q = 6\), we get
\[(p - 2q)^3 = 6^3\]

Using the algebraic identity
\[(x \pm y)^3 = x^3 \pm y^3 \pm 3xy (x \pm y)\]
\[p^3 - (2q)^3 - 3(p)(2q)(p - 2q) = 216\]
\[p^3 - 8q^3 - 6pq(p - 2q) = 216\] [Since given that \((p - 2q) = 6\)]
\[p^3 - 8q^3 - 36pq - 216 = 0\]

So the value of \(p^3 - 8q^3 - 36pq - 216\) is 0

6. Answer: D

\[-\frac{22}{7} + \left( -\frac{3}{12} \right) = -\frac{22}{7} - \frac{3}{12}\]

Take L.C.M of 7, 12 = \(7 \times 12 = 84\)
\[= \frac{-22 \times 12 - 7 \times 3}{84} = -\frac{285}{84}\]

7. Answer: A

Given that \(\frac{1}{8} - \frac{2}{4}x + 1 = 0\)
\[\frac{1}{8} + 1 = \frac{2x}{4}\]
\[\frac{1}{8} + \frac{1}{1} = \frac{x}{2}\]

Take L.C.M of 8 and 1 = \(8 \times 1 = 8\)
\[\frac{1 \times 1 + 1 \times 8}{8} = \frac{x}{2}\]
\[\frac{1 + 8}{8} = \frac{x}{2}\]
\[\frac{9}{8} = \frac{x}{2}\]

Cross multiply, \(9 \times 2 = x \times 8\)
\[18 = 8x\]
8. Answer: A

Given that equation \( x^3 - 2x^2y + 2xy^2 - y^2 = 0 \)

Substitute the options in the given equation and check whether it is satisfied

(a) \((1,1)\)

\[ x = 1, y = 1 \]

\[ x^3 - 2x^2y + 2xy^2 - y^2 = 0 \]

\[ \Rightarrow 1^3 - 2 \times 1^2 \times 1 + 2 \times 1 \times 1^2 - 1^2 = 0 \]

Therefore, it satisfies the equation

(b) \((1,2)\)

\[ x = 1, y = 2 \]

\[ x^3 - 2x^2y + 2xy^2 - y^2 = 1^3 - 2 \times 1^2 \times 2 + 2 \times 1 \times 2^2 - 2^2 \neq 0 \]

(c) \((2,1)\)

\[ x = 2, y = 1 \]

\[ x^3 - 2x^2y + 2xy^2 - y^2 = 2^3 - 2 \times 2^2 \times 1 + 2 \times 2 \times 1^2 - 1^2 \neq 0 \]

(d) \((3,1)\)

\[ x = 3, y = 1 \]

\[ x^3 - 2x^2y + 2xy^2 - y^2 = 3^3 - 2 \times 3^2 \times 1 + 2 \times 3 \times 1^2 - 1^2 \neq 0 \]

9. Answer: B

Given that:

81 can be written in powers of 3

\[ 81 = 3 \times 3 \times 3 \times 3 \]

\[ 81^{-2} = (3 \times 3 \times 3 \times 3)^{-2} = (3^4)^{-2} = 3^{-8} = \left( \frac{1}{3} \right)^8 \]

10. Answer: D

Dice contains 6 faces \((1, 2, 3, 4, 5, 6)\)

Probability of Event to happen = \( \frac{\text{Number of outcomes that make an event}}{\text{Total number of outcomes of an experiment}} \)

Total number of outcomes of an experiment = 6 faces \((1, 2, 3, 4, 5, 6)\)

Number of outcomes of the dice to show 6 = 1

Probability of the dice to show 6 = \( \frac{1}{6} \)
11. Answer: A
Given: \((a^{22} \times a^{-12}) \times (b^{-10} \times b^{20})\)

If bases are equal then their powers are to be added, \(a^m \times a^n = a^{m+n}\)

\[\begin{align*}
&= (a^{22-12}) \times (b^{-10+20}) \\
&= a^{10} \times b^{10} \\
&\text{Since, } a^m \times b^n = (ab)^{mn} = (ab)^{10}
\end{align*}\]

12. Answer: D
On doing the L.C.M, 256 is written as

\[
\begin{array}{c|cccc}
2 & 256 \\
2 & 128 \\
2 & 64 \\
2 & 32 \\
2 & 16 \\
2 & 8 \\
2 & 4 \\
2 & 2 \\
1 & 1 \\
\end{array}
\]

\(256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2\)

\[= (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2)\]

\[= 4 \times 4 \times 4 \times 4\]

\[= (4 \times 4) \times (4 \times 4)\]

\[= 16 \times 16\]

\[= 16^2\]

Square root of 256 = \(\sqrt{(16)^2}\)

\[= 16\]

Section B
(Explanation 13 to 24 carry 2 marks each)

13. Answer:

\[
\begin{align*}
(a) \quad \frac{5}{6} + \left( -\frac{2}{3} \right) + \frac{1}{3} - \left( -\frac{2}{3} + \frac{3}{2} \right) &= \frac{5}{6} - \frac{2}{3} + \frac{1}{3} - \left( -\frac{2}{3} + \frac{3}{2} \right) \\
&= \frac{5}{6} - \frac{2}{3} + \frac{1}{3} - \left( -\frac{2}{3} \times \frac{2}{3} \right) \\
&= \frac{5}{6} - \frac{2}{3} + \frac{1}{3} - \left( -\frac{4}{9} \right) \\
&= \frac{5}{6} - \frac{2}{3} + \frac{1}{3} + \frac{4}{9}
\end{align*}\]

Take L.C.M of denominator values 6, 3, 3, 9 = 18
Therefore, \( \frac{5}{6} + \left( -\frac{2}{3} \right) + \frac{1}{3} - \left( -\frac{2}{3} \div \frac{3}{2} \right) = \frac{17}{18} \)

(b) \( \frac{1}{2} \times \left( -\frac{5}{6} \right) - \left( -\frac{10}{6} \right) + \left( \frac{1}{2} \div \frac{15}{6} \right) = \frac{1}{2} \times \left( -\frac{5}{6} \right) - \left( -\frac{10}{6} \right) + \left( \frac{1}{2} \div \frac{15}{6} \right) \)

\[ = \frac{-5 + 10}{12} + \left( \frac{1}{2} \times \frac{6}{15} \right) = \frac{-5}{12} + \frac{5}{6} + \frac{1}{5} \]

Take L.C.M of denominator values 12, 3, 5 = 60

\[ = \frac{-5 \times 5 + 20 \times 6 + 12}{60} = \frac{-25 + 100 + 12}{60} \]

\[ = \frac{87}{60} \]

Therefore, \( \frac{1}{2} \times \left( -\frac{5}{6} \right) - \left( -\frac{10}{6} \right) + \left( \frac{1}{2} \div \frac{15}{6} \right) = \frac{87}{60} \)

14. Answer:

Thrice the rational number \( \frac{3}{6} \) is \( 3 \times \frac{3}{6} = \frac{3}{2} \)

Suppose \( x \) is subtracted to this number gives \( \frac{2}{5} \)

\[ \frac{3}{2} - x = \frac{2}{5} \]

\[ \frac{3}{2} - \frac{2}{5} = x \]

\[ x = \frac{3}{2} - \frac{2}{5} \]

Take L.C.M of the denominator 2, 5 = 10

\[ x = \frac{3 \times 5 - 2 \times 2}{10} = \frac{15 - 4}{10} = \frac{11}{10} \]

Therefore, \( \frac{11}{10} \) should be subtracted to thrice the rational number \( \frac{3}{6} \) to get \( \frac{2}{5} \)

15. Answer:

By doing Prime factorisation,

\[ 18252 = 2 \times 2 \times 3 \times 3 \times 3 \times 13 \times 13 \]

The prime numbers 2 and 13 do not appear in groups of three. So, that 18252 is not a perfect cube
In the factorisation, 2 will appear once and 13 will also appear once to become 18252 is a perfect cube.

Hence the smallest natural number by which 18252 should be multiplied to make it a perfect cube is $2 \times 13 = 26$

And the resulting perfect cube is $18252 \times 26 = 474552$

16. Answer:
Let us take $x$ and $y$ be two natural numbers

Given that difference between the two natural number $s = 196$

$x - y = 196 \quad \text{(1)}$

Ratio of two numbers $x : y = 9 : 5$

$x \div y = \frac{9}{5}$

Cross multiply on both sides, we get

$5x = 9y$

Substitute $x = \frac{9y}{5}$ in equation (1)

$\frac{9y}{5} - y = 196$

$\frac{9y - 5y}{5} = 196$

$\frac{4y}{5} = 196$

$4y = 196 \times 5 = 980$

$y = \frac{980}{4} = 245$

Then $x = \frac{9 \times 245}{5} = 441$

Therefore, the required two natural numbers are 441 and 245.

17. Answer:

Given that it is a triangle,

Sum of the interior angles of the triangles = 180

$x + 60 + 45 = 180$

$x = 180 - 105 = 75^\circ$

At point C it is supplementary angle, $y + 60 = 180$

$y = 180 - 60 = 120^\circ$
At point B it is supplementary angle, \( z + 45 = 180 \)

\[ z = 180 - 45 = 135^\circ \]

Therefore, the angles are \( x = 75^\circ, y = 120^\circ, z = 135^\circ \)

18. Answer:
Given that Principle amount (\( P \)) = Rs.8000
Interest rate (\( R \)) = 10
Number of years (\( N \)) = 3

We have \( A = P \left(1 + \frac{R}{100}\right)^n\)

\[ A = 8000 \left(1 + \frac{10}{100}\right)^3 \]

\[ = 8000(1 + 0.1)^3 = 8000(1.1)^3 = 10648 \]

Therefore, Compound interest = \( A - P = 10648 - 8000 = Rs. 2648 \)

19. Answer:

![Trapezium Diagram]

Given
BC = 10
BE = 4
AD = 16

Perimeter of the Trapezium = \( AB + BC + CD + DA \)

We can divide trapezium as a Rectangle (BCEF) and the two triangles (ABE and CFD)

From triangle ABE
\[ AB^2 = BE^2 + EA^2 \]
\[ AB^2 = 4^2 + 3^2 \]
\[ AB^2 = 16 + 9 = 25 \]
\[ AB = 5 \]
Since, ABE and CFD are similar triangles \( AB = CD = 5 \)

Therefore, Perimeter of the Trapezium = \( AB + BC + CD + DA \)

\[ = 5 + 10 + 5 + 16 = 36 \]

20. Answer:

Given that annual income of Afzal is 5 lakhs

Assume Income generated by Afzal = Total expenditure of Afzal

(a) According to the graph,

The amount he spent on food is 30% of the total expenditure of Afzal

The amount he spent on food = 30% of 5 lakhs

\[ = 30\% \times 500000 = 30 \times 5000 = Rs. 150000 \]

Therefore, the amount he spent on food is 150000

(b) According to the graph,

The amount he spent on food is 30% of the total expenditure of Afzal

The amount he spent on House rent is 20% of the total expenditure of Afzal

The amount he spent for House rent and Food = \((30 + 20)\%\) of the total expenditure of Afzal

\[ = 50\% \times 500000 = 50 \times 5000 = Rs 250000 \]

Therefore, the amount he spent for House rent and Food is 250000

21. Answer:

Given that

\[ \frac{3x-5}{2} + x + \frac{2x-3}{3} = \frac{5}{6} - \frac{3x}{2} \]

\[ \frac{3x-5}{2} + \frac{x}{1} + \frac{2x-3}{3} = \frac{5}{6} - \frac{3x}{2} \]

Take L.C.M. of 2, 1, 3 is 6 and L.C.M. of 6, 2 is 6

\[ \frac{(3x-5)\times3+6x+(2x-3)\times2}{6} = \frac{5-3x\times3}{6} \]

\[ \frac{9x-15+6x+4x-6}{6} = \frac{5-9x}{6} \]

\[ \frac{19x-21}{6} = \frac{5-9x}{6} \]

Cross multiply on both sides, \( 6 \times (5 - 9x) = 6 \times (19x - 21) \)

\[ 5 - 9x = 19x - 21 \]
26 = 28x
\[ x = \frac{26}{28} = 0.928 \]

22. Answer:
(a) If a number is divisible by 9, the sum of the digits of the number is divisible by 9
Given number is 231325x = 2 + 3 + 1 + 3 + 2 + 5 + x = 16 + x
16 + x is divisible by 9, when x values are 2, 11, 20 - - - - - - -
Therefore, the least number of x is 2.
(b) If a number is divisible by 11, (Sum of all odd digit values) – (Sum of all even digit
Values) = divisible by 11
Given number
1051x85 = (1 + 5 + x + 5) – (0 + 1 + 8) = 11 + x – 9 = 2 + x
2 + x is divisible by 11 when x values are 9, 20, - - - - - -
Therefore, the least number of x is 9.

23. Answer:
Given that
Marked price (M.P) = Rs.5000
Selling price (S.P) = Rs.2250
Discount = Marked price – Selling price
= 5000 – 2250 = Rs.2750
On marked price of Rs.5000, the discount is Rs.2750.
On MP of Rs.100, the discount percentage will be
Discount % = \( \frac{2750}{5000} \times 100 \) = 55 %

24. Let us take the age of Ganesh is ‘x’, age of Ramesh is ‘y’
Sum of their ages, \( x + y = 35 \) - - - - - (1)
Ganesh is 5 years elder than Ramesh, \( x = y + 5 \)
Substitute value of x value in equation (1)
\[ y + 5 + y = 35 \]
\[ 2y + 5 = 35 \]
\[ 2y = 35 - 5 = 30 \]
\[ y = \frac{30}{2} = 15 \]
\[ x = y + 5 = 15 + 5 = 20 \]

Therefore, age of Ganesh is 15 and age of Ramesh is 20.

**Section C**

(Explanations 25 to 32 carry 3 marks each)

25. Answer:

(i) 

(ii)
26. Answer:
Given that
A box contains,
No. of red balls = 4
No. of green balls = 5
No. of blue balls = 6

(a) The probability of getting a green ball = \( \frac{\text{Number of outcomes that get a green ball}}{\text{Total number of green balls}} \)
= \( \frac{1}{5} \)
(b) The probability of getting a blue ball = \( \frac{\text{Number of outcomes that get a blue ball}}{\text{Total number of blue balls}} \)
= \( \frac{1}{6} \)
(c) The probability of getting a non-red ball = \( 1 - \frac{\text{Number of outcomes that get a red ball}}{\text{Total number of red balls}} \)
For getting non-red balls, we simply subtract the probability of getting red ball to total probability
= \( 1 - \frac{1}{4} = \frac{4-1}{4} = \frac{3}{4} \)
Therefore, the probability of getting a non-red ball = \( \frac{3}{4} \)

27. Answer:
Given that
Overall CP of each book = Rs.800
One is sold at a loss of 10%
This means if CP is Rs.100, then SP is Rs.90

Therefore, when CP is Rs.800, then SP = \( \frac{90}{100} \times 800 = 720 \)

Also, the second book is sold at a profit of 15%

It means, if CP is Rs.100, then SP is Rs.115.

Therefore, when CP is Rs.800, then SP = \( \frac{115}{100} \times 800 = 920 \)

Now, we need to find the combined CP and SP to say whether there was an overall profit or loss.

Total CP = Rs.800 + Rs.800 = Rs.1600

Total SP = Rs.720 + Rs.920 = Rs.1640

Since Total SP > Total CP,

Profit = (1640 – 1600) = 40

Hence Rs.40 has been made as profit.

28. Answer:

Top view =

Front view =

Side view =

29. Answer:

Given that area of the trapezium is 480 \( m^2 \)

\[
\frac{1}{2} (a + b) \times h = 480
\]

\[
(a + b) \times h = 480 \times 2 = 960
\]

Smallest side of the trapezium (a) = 10

Height of the trapezium (h) = 20
(10 + b) × 20 = 960
10 + b = 48
b = 48 - 10 = 38 m

30. Answer:
Pie chart for the given data:

31. Given that Principle amount (P) = Rs.14000
Interest rate (R) = 8
Number of years (N) = 2
Simple interest:
Simple interest = \( \frac{PNR}{100} \)
= \( \frac{14000 \times 2 \times 8}{100} \) = Rs. 2240
Therefore, Simple interest = Rs.2240

Compound interest:
We have \( A = P \left( 1 + \frac{R}{100} \right)^N \)
\( A = 14000 \left( 1 + \frac{8}{100} \right)^2 \)
= 14000(1 + 0.08)^2 = 14000(1.08)^2 = 16329.6
Therefore, Compound interest = A – P = 16329.6 – 14000 = Rs.2329.6

Extra amount Pawan has to pay = difference between compound interest and simple interest
= 2940 – 2329.6 = Rs.610.4

Therefore, the extra amount Pawan has to pay is Rs.610.4

32. Answer:
\[(x^2 + 2x + 3)(x^2 - 3)(x - 1) = (x^2 + 2x + 3)(x^2 - 1) - 3 (x - 1)\]
= \[(x^2 + 2x + 3)(x^3 - x^2 - 3x + 1)\]
= \[x^5 - x^4 - 3x^3 + x^2 + 2x^4 - 2x^3 - 6x^2 + 2x + 3x^3 - 3x^2 - 9x + 3\]
= \[x^5 + x^4 - 2x^3 - 8x^2 - 7x + 3\]
Therefore, \((x^2 + 2x + 3)(x^2 - 3)(x - 1) = x^5 + x^4 - 2x^3 - 8x^2 - 7x + 3\)

Section D
(Explanations 33 to 37 carry 4 marks each)

33. Answer:

(a) Given that \[\frac{36x^2y(x - y)^2}{(x^2 - xy)}\]
= \[\frac{36x^2y(x - y)^2}{x(x - y)}\] \[\frac{36x^2y(x - y)x(x - y)}{x(x - y)}\]
Cancel the same terms in numerator and denominator
= \[36 xy(x - y) = 36x^2y - 36xy^2\]

(b) Given that \[\frac{x^3 - y^3}{(x - y)^6}\]
We know that \[a^3 - b^3 = (a - b)(a^2 + ab + b^2)\]
= \[\frac{x^3 - y^3}{(x - y)^6} = \frac{(x - y)(x^2 + xy + y^2)}{(x - y)^6}\]
= \[\frac{x^2 + xy + y^2}{(x - y)^5}\]

34. Answer:

(a) \[91^2 - 23^2\]
We know that \[(a^2 - b^2) = (a + b)(a - b)\]
Here \(a = 91, b = 23\)
\[91^2 - 23^2 = (91 + 23)(91 - 23) = 114 \times 68 = 7752\]
We write this as \(101 \times 99\)

\[101 \times 99 = (100 + 1)(100 - 1)\]

We know that \((a + b)(a - b) = (a^2 - b^2)\)

*Here* \(a = 100, b = 1\)

\[= (100^2 - 1^2) = 10000 - 1 = 9999\]

(c) \(999^2 = (1000 - 1)^2\)

This is in the form of \((a - b)^2 = a^2 - 2ab + b^2\)

*Here* \(a = 1000, b = 1\)

\[(1000 - 1)^2 = 1000^2 - 2 \times 1000 \times 1 + 1\]

\[= 1000000 - 2000 + 1 = 998001\]

35. Answer:

Given that analysis of demand and production rate of 4 automobile companies

(a) According to the graph

<table>
<thead>
<tr>
<th>Companies</th>
<th>Demand</th>
<th>Production</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honda</td>
<td>3000</td>
<td>1000</td>
<td>2000</td>
</tr>
<tr>
<td>TVS</td>
<td>600</td>
<td>1300</td>
<td>-700</td>
</tr>
<tr>
<td>Hyundai</td>
<td>2500</td>
<td>700</td>
<td>1800</td>
</tr>
<tr>
<td>Tata</td>
<td>1200</td>
<td>800</td>
<td>400</td>
</tr>
</tbody>
</table>

On observing the above table, TVS Company meets high demand over the rate of production because the production rate of TVS is high when compared to its Demand

(b) Average = \[\frac{\text{Sum of elements}}{\text{Number of elements}}\]

Average production rate of all companies = \[\frac{\text{Sum of the production rates of all companies}}{\text{Total no. of companies}}\]

Sum of the production rates of all companies = 1000 + 1300 + 700 + 800 = 3800

Total no of companies = 4

Average production rate of all companies = \[\frac{3800}{4} = 950\]

(c) Honda:

Demand (D) = 3000
Production (P) = 1000
Difference between Demand and Production of Honda = D – P = 3000 - 1000 = 2000

Tata:
Demand (D) = 1200
Production (P) = 800
Difference between Demand and Production of Tata = D – P = 1200 – 800 = 400
Given, the difference between Demand and Production of Honda is x times of Tata
Therefore, 2000 = x400
\[ x = \frac{2000}{400} = 5 \]
Thus, the value of x is 5.

36. Answer:
Given that
Total cash with ATM = 400000
The ratio of the number of 500, 100, 50 = 3 : 3 : 4
Let’s take, ‘X’ denominations
\[ 3 \times 500 \times X + 3 \times 100 \times X + 4 \times 50 \times X = 400000 \]
\[ 1500X + 300X + 200X = 400000 \]
\[ 2000X = 400000 \]
\[ X = 200 \]
Therefore, Number of Rs.500 notes = 3X = 3 \times 200 = 600
Number of Rs.100 notes = 3X = 3 \times 200 = 600
Number of Rs.50 notes = 4X = 4 \times 200 = 800

37. Answer:
Given figure is divided into three figures: 2 triangles and 1 rectangle
Triangle ABC:

Area of the triangle ABC = \( \frac{1}{2} \times \text{base} \times \text{height} \)

= \( \frac{1}{2} \times AC \times \text{height} = \frac{1}{2} \times 7 \times 5 = 17.5 \text{ m}^2 \)

Area of the triangle FED = \( \frac{1}{2} \times \text{base} \times \text{height} \)

= \( \frac{1}{2} \times FD \times \text{height} = \frac{1}{2} \times 7 \times 5 = 17.5 \text{ m}^2 \)

Rectangle ACDF:

Area of the rectangle ACDF = AC \times AF

= 7 \times 8 = 56

Therefore, area of the whole figure = Area of the triangle ABC + Area of the triangle FED + Area of the rectangle ACDF

= 17.5 + 17.5 + 56 = 91 \text{ m}^2