CBSE Class 10 Maths Solutions

30/3/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. \((x + 5)^2 = 2(5x - 3) \Rightarrow x^2 + 31 = 10\)

   \[D = -124\]

2. \[
\frac{27}{2^3 \cdot 5^4 \cdot 3^2} = \frac{3}{2^3 \cdot 5^4}
\]

   It will terminate after 4 decimal places

OR

429 = 3 \times 11 \times 13

3. \[S_{10} = \frac{10}{2} [2 \times 6 + 9 \times 6]\]

   \[= 330\]

4. \(AB = 5\)

   \[\Rightarrow \sqrt{(x - 0)^2 + (-4 - 0)^2} = 5\]

   \[x^2 + 16 = 25\]

   \[x = \pm 3\]

5. Length of chord = \(2\sqrt{a^2 - b^2}\)

6. \(PQ = 5\) cm

   \[\tan \theta = \frac{PQ}{PR} = \frac{5}{9}\]

OR

\[\sec \alpha = \sqrt{1 + \tan^2 \alpha}\]

\[= \sqrt{1 + \frac{25}{144}} = \frac{13}{12}\]

30/3/1 (1)
7. Diagonals of parallelogram bisect each other

\[
\begin{align*}
\text{∴ } \left( \frac{3 + a}{2}, \frac{1 + b}{2} \right) &= \left( \frac{5 + 4}{2}, \frac{1 + 3}{2} \right) \\
3 + a &= 9, \quad 1 + b = 4
\end{align*}
\]

So \( a = 6, \ b = 3 \)

OR

P divides AB in the ratio 1 : 2

\[
\begin{align*}
\text{Coordinates of } P &\quad \left( \frac{0 - 4}{3}, \frac{8 + 0}{2} \right) = \left( \frac{-4}{3}, \frac{8}{3} \right) \\
\text{Q divides AB in the ratio } 2 : 1
\end{align*}
\]

\[
\begin{align*}
\text{Coordinates of } Q &\quad \left( \frac{0 - 2}{3}, \frac{16 + 0}{3} \right) = \left( \frac{-2}{3}, \frac{16}{3} \right)
\end{align*}
\]

8. \( 3x - 5y = 4 \)  
\( 9x - 2y = 7 \)  
\( 9x - 15y = 12 \)  
\( 9x - 2y = 7 \)  
\( -13y = 5 \Rightarrow y = -\frac{5}{13} \)

From (1), \( x = \frac{9}{13} \) \( \therefore \text{solution is } \left( \frac{9}{13}, -\frac{5}{13} \right) \)

9. HCF \((65, 117) = 13\)

\( 13 = 65n - 117 \)

Solving, we get, \( n = 2 \)
30/3/1

OR

Required minimum distance = LCM (30, 36, 40)

30 = 2 \times 3 \times 5 = 2^1 \times 3^1 \times 5^1

36 = 2^2 \times 3^2 = 360 \text{ cm}

40 = 2^3 \times 5

10. Composite numbers on a die are 4 and 6

∴ \ P (\text{composite number}) = \frac{2}{6} \text{ or } \frac{1}{3}

Prime numbers are 2, 3 and 5

∴ \ P(\text{prime number}) = \frac{3}{6} \text{ or } \frac{1}{2}

11. \ x^2 - 8x + 18 = 0

\ x^2 - 8x + 16 + 2 = 0

(x - 4)^2 = -2

Square of a number can’t be negative

∴ The equation has no solution.

12. Total number of possible outcomes = 34

Favourable number of outcomes is (7, 14, 21, 28 and 35) = 5

P(multiple of 7) = \frac{5}{34}

SECTION C

13. \ AB^2 = AD^2 + BD^2 \quad \text{Correct Figure}

\ AC^2 = AD^2 + CD^2

\ AB^2 - AC^2 = BD^2 - CD^2

= (3CD)^2 - CD^2

= 8 \ CD^2
\[ 30/3/1 \]

\[ 8 \times \left( \frac{1}{4} BC \right)^2 \]

\[ \Rightarrow 2AB^2 - 2AC^2 = BC^2 \]

or \[ 2AB^2 = 2AC^2 + BC^2 \]

\[ \text{OR} \]

Correct Figure \[ \frac{1}{2} \]

\[ \Delta ABC \sim \Delta PQR \]

\[ \therefore \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} \]

\[ \frac{AB}{PQ} = \frac{2BD}{2QM} \text{ or } \frac{BD}{QM} \]

Also \[ \angle B = \angle Q \]

\[ \therefore \Delta ABD \sim \Delta PQM \]

\[ \text{So } \frac{AB}{PQ} = \frac{AD}{PM} \]

14.

\[
\begin{array}{c}
x^3 - 3x + 1 \frac{x^5 - 4x^3 + x^2 + 3x + 1}{x^2 - 1} \\
- x^5 + 3x^3 + x^2 \\
\end{array}
\]

\[
\begin{array}{c}
x^4 + 3x^2 + 1 \frac{-x^3 + 3x - 1}{+ - +} \\
\end{array}
\]

\[ 2 \]

(4) 30/3/1
Since remainder $\neq 0 \therefore g(x)$ is not a factor of $p(x)$

15. Coordinates of mid points are

D(1, 2)
E (1, 0)
F(0, 1)

Area of $\triangle DEF = \frac{1}{2} [1(0 - 1) + 1(1 - 2) + 0]$
\[= \frac{1}{2}(-2) = 1 \text{ sq. unit} \]

16. Correct graph

Solution is
\[x = 2, y = 3 \quad \frac{1}{2} + \frac{1}{2} \]

17. Let us assume that $\sqrt{3}$ be a rational number

\[\sqrt{3} = \frac{p}{q} \quad \text{where } p \text{ and } q \text{ are co-primes and } q \neq 0 \]
\[\Rightarrow p^2 = 3q^2 \quad \text{...(1)} \]

\[\therefore \text{ 3 divides } p^2 \]
\[\text{i.e., 3 divides } p \text{ also} \quad \text{...(2)} \]
Let $p = 3m$, for some integer $m$
From (1), $9m^2 = 3q^2$
\[\Rightarrow q^2 = 3m^2 \]
\[\therefore \text{ 3 divides } q^2 \text{ i.e., 3 divides } q \text{ also} \quad \text{...(3)} \]
From (2) and (3), we get that 3 divides p and q both which is a contradiction to the fact that p and q are co-primes. Hence our assumption is wrong.

\[ \therefore \sqrt{3} \text{ is irrational} \]

OR

\[ 1251 - 1 = 1250, \ 9377 - 2 = 9375, \ 15628 - 3 = 15625 \]

Required largest number = \( \text{HCF} (1250, 9375, 15625) \)

\[
\begin{align*}
1250 &= 2 \times 5^4 \\
9375 &= 3 \times 5^4 \\
6250 &= 2 \times 5^5
\end{align*}
\]

\[ \therefore \text{HCF} (1250, 9375, 15625) = 5^4 = 625 \]

18. A, B, C are interior angles of \( \triangle ABC \)

\[ \therefore A + B + C = 180^\circ \]

(i) \[
\sin \left(\frac{B + C}{2}\right) = \sin \left(\frac{180^\circ - A}{2}\right) = \sin \left(90^\circ - \frac{A}{2}\right) = \cos \frac{A}{2} \]

(ii) \[
\tan \left(\frac{B + C}{2}\right) = \tan \left(\frac{90^\circ}{2}\right) = \tan 45^\circ = 1
\]

OR

\[ \tan (A + B) = 1 \therefore A + B = 45^\circ \]

\[ \tan (A - B) = \frac{1}{\sqrt{3}} \therefore A - B = 30^\circ \]

Solving, we get \( \angle A = 37\frac{1^\circ}{2} \) or \( 37.5^\circ \)

\[ \angle B = 7\frac{1^\circ}{2} \text{ or } 7.5^\circ \]
19.

Let TR be x cm and TP be y cm

OT is ⊥ bisector of PQ

So PR = 4 cm

In ΔOPR, \( OP^2 = PR^2 + OR^2 \)

∴ OR = 3 cm

In ΔPRT, \( y^2 = x^2 + 4^2 \) ...(1)

In ΔOPT, \( (x + 3)^2 = 5^2 + y^2 \)

∴ \( (x + 3)^2 = 5^2 + x^2 + 16 \) [using (1)]

Solving we get \( x = \frac{16}{3} \) cm

From (1), \( y^2 = \frac{256}{9} + 16 = \frac{400}{9} \)

So \( y = \frac{20}{3} \) cm

OR

\( ΔROC \equiv ΔQOC \)

∴ \( \angle 1 = \angle 2 \)

Similarly \( \angle 4 = \angle 3 \)

\( \angle 5 = \angle 6 \)

\( \angle 8 = \angle 7 \)

\( \angle ROQ + \angle QOP + \angle POS + \angle SOR = 360° \)

∴ \( 2\angle 1 + 2\angle 4 + 2\angle 5 + 2\angle 8 = 360 \)

⇒ \( \angle 1 + \angle 4 + \angle 5 + \angle 8 = 180° \)
So, $\angle DOC + \angle AOB = 180^\circ$

and $\angle AOD + \angle BOC = 180^\circ$.

20. Volume of water flowing through canal in 30 minutes

\[ = 5000 \times 6 \times 1.5 = 45000 \text{ m}^3 \]

Area = $\frac{45000 \times 8}{100}$

\[ = 562500 \text{ m}^2 \]

21.

<table>
<thead>
<tr>
<th>Number of days</th>
<th>Number of students (fi)</th>
<th>$x_i$</th>
<th>$f_i x_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6</td>
<td>10</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>6-12</td>
<td>11</td>
<td>9</td>
<td>99</td>
</tr>
<tr>
<td>12-18</td>
<td>7</td>
<td>15</td>
<td>105</td>
</tr>
<tr>
<td>18-24</td>
<td>4</td>
<td>21</td>
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<tr>
<td>24-30</td>
<td>4</td>
<td>27</td>
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</tr>
<tr>
<td>30-36</td>
<td>3</td>
<td>33</td>
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</tr>
<tr>
<td>36-42</td>
<td>1</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td></td>
<td>564</td>
</tr>
</tbody>
</table>

\[ \bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{564}{40} = 14.1 \]

22. Total area cleaned = $2 \times$ Area of sector

\[ = 2 \times \frac{\pi r^2 \theta}{260^\circ} \]

\[ = 2 \times \frac{22}{7} \times 21 \times 21 \times \frac{120^\circ}{360^\circ} \]

\[ = 924 \text{ cm}^2 \]
23. Correct Figure

PB – PA = 7 m

Let AP be x m \[ \therefore PB = (x + 7) \text{ m} \]

\[ AB^2 = PB^2 + AB^2 \]

\[ \therefore 13^2 = (x + 7)^2 + x^2 \]

\[ x^2 + 7x - 60 = 0 \]

\[ = (x + 12)(x - 5) = 0 \]

\[ \therefore x = 5, -12 \text{ Rejected} \]

\[ \therefore \text{Situation is possible} \]

\[ \therefore \text{Distance of pole from gate A = 5 m} \]

and distance of pole from gate B = 12 m.

24. \[ ma_m = na_n \]

\[ \Rightarrow ma + m(m - 1)d = na + n(n - 1)d \]

\[ \Rightarrow (m - n)a + (m^2 - m - n^2 + n)d = 0 \]

\[ \Rightarrow (m - n)a + [(m - n)(m + n) - (m - n)d] = 0 \]

Dividing by \( (m - n) \)

So, \[ a + (m + n - 1)d = 0 \]

or \[ a_{m+n} = 0 \]

OR

Let first three terms be a – d, a and a + d

\[ a - d + a + a + d = 18 \]

So \[ a = 6 \]

\[ (a - d)(a + d) = 5d \]
\[ 6^2 - d^2 = 5d \]

or \[ d^2 + 5d - 36 = 0 \]

\[(d + 9)(d - 4) = 0 \]

so \[ d = -9 \text{ or } 4 \]

For \( d = -9 \) three numbers are 15, 6 and -3

For \( d = 4 \) three numbers are 2, 6 and 10

25. Correct construction of \( \triangle ABC \)

26. (a) Total surface area of block

\[ = \text{TSA of cube} + \text{CSA of hemisphere} - \text{Base area of hemisphere} \]

\[ = 6a^2 + 2\pi r^2 - \pi r^2 \]

\[ = 6a^2 + \pi r^2 \]

\[ = \left( 6 \times 6^2 + \frac{22}{7} \times 2.1 \times 2.1 \right) \text{cm}^2 \]

\[ = (216 + 13.86) \text{ cm}^2 \]

\[ = 229.86 \text{ cm}^2 \]

(b) Volume of block

\[ = \left( \frac{2}{3} \times \frac{22}{7} \times (2.1)^3 \right) \]

\[ = (216 + 19.40) \text{ cm}^3 \]

\[ = 235.40 \text{ cm}^3 \]

OR

Volume of frustum = 12308.8 cm\(^3\)

\[ \Rightarrow \frac{1}{3} \pi h \left( r_1^2 + r_2^2 + r_1 r_2 \right) = 12308.8 \]

\[ \Rightarrow \frac{1}{3} \times 3.14 \times h \left( 20^2 + 12^2 + 20 \times 12 \right) = 12308.8 \]

\[ h = \frac{12308.8 \times 3}{784 \times 3.14} \]

\[ h = 15 \text{ cm} \]

(10)
\[ l = \sqrt{15^2 + (20 - 12)^2} = 17 \text{ cm.} \]

Area of metal sheet used = \( \pi l \left( r_1 + r_2 \right) + \pi r_2^2 \)
\[ = 3.14 [17 \times 32 + 12^2] \]
\[ = 3.14 \times 688 \text{ cm}^2 \]
\[ = 2160.32 \text{ cm}^2 \]

27. Correct figure, given, to prove and construction
\[ \frac{1}{2} \times 4 = 2 \]
Correct proof.

OR

Correct figure, given, to prove and construction
\[ \frac{1}{2} \times 4 = 2 \]
Correct proof.

28. \[ 1 + \sin^2 \theta = 3\sin \theta \cos \theta \]
Dividing by \( \cos^2 \theta \)
\[ \sec^2 \theta + \tan^2 \theta = 3 \tan \theta \]
\[ \Rightarrow \quad 1 + \tan^2 \theta + \tan^2 \theta = 3 \tan \theta \]
\[ \Rightarrow \quad 2 \tan^2 \theta - 3 \tan \theta + 1 = 0 \]
\[ (\tan \theta - 1) (2 \tan \theta - 1) = 0 \]
So \( \tan \theta = 1 \) or \( \frac{1}{2} \)

Alternate method
\[ 1 + \sin^2 \theta = 3 \sin \theta \cos \theta \]
\[ \sin^2 \theta + \cos^2 \theta + \sin^2 \theta - 3 \sin \theta \cos \theta = 0 \]
Dividing by \( \cos^2 \theta \)
\[ \Rightarrow \quad 2 \tan^2 \theta - 3 \tan \theta + 1 = 0 \]
\[ \Rightarrow \quad (\tan \theta - 1) (2 \tan \theta - 1) = 0 \]
So \( \tan \theta = 1 \) or \( \frac{1}{2} \)
### 29. Class interval

<table>
<thead>
<tr>
<th>Class interval</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
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<td>More than or equal to 20</td>
<td>100</td>
</tr>
<tr>
<td>More than or equal to 30</td>
<td>90</td>
</tr>
<tr>
<td>More than or equal to 40</td>
<td>82</td>
</tr>
<tr>
<td>More than or equal to 50</td>
<td>70</td>
</tr>
<tr>
<td>More than or equal to 60</td>
<td>46</td>
</tr>
<tr>
<td>More than or equal to 70</td>
<td>40</td>
</tr>
<tr>
<td>More than or equal to 80</td>
<td>15</td>
</tr>
</tbody>
</table>

**Correct Table**

Plotting of points (20, 100), (30, 90), (40, 82), (50, 70), (60, 46), (70, 40) and (80, 15)

Joining the points to get a curve

### 30.

Let \( AB = h \) be the height of tower

\[
\text{ln } \triangle ABC, \quad \frac{h}{x} = \tan 60^\circ
\]

\[ h = x\sqrt{3} \]

\[
\text{ln } \triangle ABD, \quad \frac{h}{x + 40} = \tan 30^\circ
\]

\[ h\sqrt{3} = x + 40 \]

\[ 3x = x + 40 \]

\[ \therefore x = 20 \]

So, height of tower = \( h = 20\sqrt{3} \) m

\[ = 20 \times 1.732 \text{ m} \]

\[ = 34.64 \text{ m} \]