Answer Key & Solution

1. (B)
The required ratio is 1 : 3 : 5 : ….so on

2. (A)
Since the last five steps covering 5 m land the drunkard fell into the pit, the displacement prior to this is (11 – 5) m = 6 m.
Time taken for first eight steps (displacement in first eight steps = 5 – 3 = 2 m) = 8 s. then time taken to cover first 6 m of journey $= \frac{6}{2} \times 8 = 24s$
Time taken to cover last 5 m = 5s
Total time = 24 + 5 = 29 s

3. (C)
Here $h = \frac{1}{2} \times 10 \times (5)^2 = 125m$
In 3 s it falls through : $h_1 = \frac{1}{2} \times 10 \times (5)^2 = 125m$
Rest 80 m is covered in 4s. Hence, total time taken is 3s + 4s = 7s

4. (A)
Time of fall $= \sqrt{\frac{2h}{g}}$
Time taken by the sound to come out = $\frac{h}{c}$
Total time = $\sqrt{\frac{2h}{g}} + \frac{h}{c} = h\left[\sqrt{\frac{2}{gh}} + \frac{1}{c}\right]$

5. (A)
Suppose h be the height of each storey. Then
$25h = 0 + \frac{1}{2} \times 10 \times t^2 = \frac{1}{2} \times 10 \times 5^2$ or h = 5m
If first second, let the stone passes through n storey. So
$n \times 5 = \frac{1}{2} \times 10 \times (1)^2$ or $n = 1$

6. (A)

The velocity v acquired by the parachutist after 10 s:

$$v = u + gt = 0 + 10 \times 10 = 100\,\text{ms}^{-1}$$

Then, $s_1 = ut + \frac{1}{2}gt^2 = 0 + \frac{1}{2} \times 10 \times 10^2 = 500\,\text{m}$

The distance travelled by the parachutist under retardation is

$$s_2 = 2495 - 500 = 1995\,\text{m}$$

Let v_g be the velocity on reacting the ground. Then $v_g^2 - v^2 = 2as_2$

Or $v_g^2 - (100)^2 = 2 \times (-2.5) \times 1995$ or $v_g = 5\,\text{ms}^{-1}$

7. (C)

If police is able to catch the dacoit after time t, then

$$\text{vt} = \text{x} + \frac{1}{2}\alpha\text{x}^2$$

This gives $\frac{\alpha}{2}\text{t}^2 - \text{vt} + \text{x} = 0$

Or $\text{t} = \frac{\text{v} \pm \sqrt{\text{v}^2 - 2\alpha\text{x}}}{\alpha}$

For t to be real, $\text{v}^2 \geq 2\text{ax}$

8. (D)

Here relative velocity of the train w.r.t. other train is V – v. Hence, $0 - (\text{V} - \text{v})^2 = 2\text{ax}$

Or $\text{a} = -\frac{(\text{V} - \text{v})^2}{2\text{x}}$ Minimum retardation $= \frac{(\text{V} - \text{v})^2}{2\text{x}}$

9. (B)

Distance covered $= \text{S} = \text{v}_{\text{av}} \times \text{time}$

For first second: $\text{S}_1 = 5 \times 1 = 5\text{m}$

For second : $\text{S}_2 = 10 \times 1 = 10\text{m}$

For third second: $\text{S}_3 = 15 \times 1 = 15\text{m}$

Total distance travelled

$$\text{S} = \text{S}_1 + \text{S}_2 + \text{S}_3 = 5 + 10 + 15 = 30\text{m}$$

10. (B)

Given $\text{v}_{\text{av}} = \frac{\text{v} + \text{u}}{2} = 0.34$ and $\text{v} - \text{u} = 0.18$

Solving these two equations, we get

u = 0.25 ms^{-1} , v = 0.43 ms^{-1}. Given s = 3.06 m

Now use $\text{v}^2 - \text{u}^2 = 2\text{as}$ to find a = 0.02 ms^{-1}

11. (D)

By the time fifth water drop starts falling, the first water drop reaches the ground.

$$u = 0, h = \frac{1}{2}gt^2 \Rightarrow 5 = \frac{1}{2} \times 10 \times t^2 \Rightarrow t = 1\text{s}$$

Hence, the interval of falling of each water drop is $\frac{1\text{s}}{4} = 0.25\text{s}$

When the fifth drop starts its journey towards ground,
the third drop travels in air for 0.25 + 0.25 = 0.5
Therefore, height (distance) covered by third drop in air is

$$h_1 = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times (0.5)^2 = 5 \times 0.25 = 1.25\text{ m}$$

The third water drop will be at a height of

$$5 - 1.25 = 3.75\text{m}$$

12. (D)

Let *u* he velocity of projection of the stone.
The maximum height a boy can throw a stone.

$$H_{\max} = \frac{u^2}{2g} = 10\text{m}$$

The maximum horizontal distance the boy can throw the same stone is equal to maximum range

$$R_{\max} = \frac{u^2 \sin\left(2 \times 45^\circ\right)}{g} = \frac{u^2 \sin 90^\circ}{g} = \frac{u^2}{g}$$

$$H_{\max} = \frac{u^2}{g} = 20\text{m}$$

13. (C)

The time taken to reach the ground depends on the height from which the bullets are fired when the bullets are fired horizontally. Here height is same for both the bullets, and hence the bullets will reach the ground simultaneously.

14. (C)

$$y_1 = \frac{u^2 \sin^2\theta}{2g}, y_2 = \frac{u^2 \sin^2(90^\circ - \theta)}{2g} = \frac{u^2 \cos^2\theta}{2g}$$

$$\Rightarrow y_1 + y_2 = \frac{u^2}{2g}$$

15. (A)

Since R = 2H

$$\text{or} \frac{v^2 \sin 2\theta}{g} = 2 \times \frac{v^2 \sin^2\theta}{2g}$$

$$\text{or } 2\sin\theta\cos\theta = \sin^2\theta \text{ or } \tan\theta = 2$$

$$R = \frac{v^2 \sin 2\theta}{g}$$

$$= \frac{v^2 2\sin\theta\cos\theta}{g} = \frac{2v^2}{g} \times \frac{2}{\sqrt{5}} \times \frac{1}{\sqrt{5}} \times \frac{4v^2}{5g}$$

16. (B)

At maximum height $v = u\cos\theta$

$$\frac{u}{2} = v \Rightarrow \cos\theta = \frac{1}{2} \Rightarrow \theta = 60^{o}$$

$$R = \frac{u^2 \sin 2\theta}{g}$$

$$= \frac{u^2 \sin\left(120^{o}\right)}{g}$$

$$= \frac{u^2 \cos 30^{o}}{g} = \frac{\sqrt{3}u^2}{2g}$$

17. (B)

$$H = 100\text{m}, R = 2 \times 200 = 400\text{m}$$

$$\tan\theta = \frac{4H}{R} \Rightarrow \tan\theta = \frac{4 \times 100}{400} = 1$$

$$\Rightarrow \theta = 45^{o}\left[\because \frac{H}{R} = \frac{\tan\theta}{4}\right]$$

18. (D)

$$\frac{R}{T^2} = \frac{u^2 \sin 2\theta / g}{4u^2 \sin^2\theta / g^2} = \frac{g}{2}\cot\theta$$

$$\text{i.e.,} gT^2 = 2R\tan\theta$$

If T is doubled, then R becomes 4 times.

19. (A)

For the person to be able to catch the ball, the horizontal component of velocity of the ball should be same as the speed of the person, i.e.,

$$v_0 \cos\theta = \frac{v_0}{2} \text{ or } \cos\theta = \frac{1}{2} \text{ or } \theta = 60^{o}$$

20. (A)

The time of flight is given by

$$T = \frac{2u\sin\theta}{g} = \frac{2 \times 30 \times 1/2}{10} = 3\text{s}$$

Thus, after 1.5s, the body will be at the highest point.

So the direction of motion will be horizontal after 1.5 s, the angle with the horizontal is 0^{o}.

21. (C)

h = 150 – 27.5 = 122.5 m

Time taken, $T = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 122.5}{9.8}} = 5\text{s}$

Now s= uT or 30 = 5u or u = 6ms^{-1}

22. (D)

$$h = \frac{u^2 \sin^2\theta}{2g} \text{ and } R = \frac{u^2 \sin 2\theta}{g}$$

$$\frac{h}{R} = \frac{45}{180} = \frac{\tan\theta}{4} \text{ or } \theta = 45^\circ$$

23. (D)

Range $= 150 = ut$ and $h = \frac{15}{100} = \frac{1}{2} \times gt^2$

Or $t^2 = \frac{2 \times 5}{100 \times g} = \frac{30}{1000}$ or $t = \frac{\sqrt{3}}{10}$

$$u = \frac{150}{t} = \frac{150 \times 10}{\sqrt{3}} = 500\sqrt{3} \text{ ms}^{-1}$$

24. (B)

$$\frac{R}{T^2} = g\frac{\sin 2\theta}{4\sin^2\theta} = \frac{g}{2}\cot\theta = 5\cot\theta$$

Given, $\frac{R}{T^2} = 5$; Hence, $5 = 5\cot\theta$ or $\theta = 45^\circ$

25. (D)

Velocity of police van $= 30 \times \frac{5}{18} = \frac{25}{3}$ ms^{-1}

Muzzle speed of the bullet = 150 ms^{-1}

Speed of the bullet w.r.t. ground = [150 + (25/3)] ms^{-1}

Velocity of thief's car is

$$192 \times \frac{5}{18} = \frac{32 \times 5}{3} = \frac{160}{3} \text{ ms}^{-1}$$

Relative velocity of bullet w.r.t. thief's car is

$$= 150 + \frac{25}{3} - \frac{160}{3}$$

$$= 150 - \frac{135}{3} = 105 \text{ ms}^{-1}$$

Answer Key

26. (A)
27. (D)
28. (A)
29. (B)
30. (A)
31. (A)
32. (A)
33. (D)
34. (B)
35. (A)
36. (B)
37. (C)
38. (C)
39. (C)
40. (D)
41. (B)
42. (C)
43. (C)
44. (B)
45. (D)
46. (B)
47. (C)
48. (B)
49. (B)
50. (C)

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TOPIC: TRIGONOMETRY - I

QUADRATIC EQUATIONS

Answer Key

51. (D)
52. (A)
53. (C)
54. (B)
55. (C)
56. (A)
57. (D)
58. (B)
59. (C)
60. (B)
61. (D)
62. (C)
63. (B)
64. (C)
65. (D)
66. (A)
67. (B)
68. (A)
69. (B)
70. (B)
71. (A)
72. (A)
73. (C)
74. (B)
75. (D)