EXPRESSWALA ACADEMY

Maths 1A: Heights and Distances

MCQ Test, Set 09

Time: 30 minutes | Maximum marks: 25

Name: _____ Class: _____ Date: _____

1. There are 25 questions. Each has exactly one correct answer: choose A, B, C or D.
2. Each correct answer carries 1 mark. There is no negative marking.
3. The key sheet and worked solutions are at the end of this test.

1. From a point 18 m away from the foot of a building, the angle of elevation of its top is 15°. Its height is

A. $18(2-\sqrt{3})$ m **B.** $18(\sqrt{3}+2)$ m
C. $\frac{9(\sqrt{6}+\sqrt{2})}{2}$ m **D.** $\frac{9(\sqrt{6}-\sqrt{2})}{2}$ m

2. A tree is 45 m high. From a point $15\sqrt{3}$ m from its foot, the angle of elevation of its top is

A. 45° **B.** 60° **C.** 30° **D.** 75°

3. A tree is 120 m high. By how much is its shadow longer when the sun's elevation is 15° than when it is 30°?

A. $80(2\sqrt{3}-3)$ m **B.** $240(\sqrt{3}+1)$ m
C. 60 m **D.** 240 m

4. From a point 84 m away from the foot of a chimney, the angle of elevation of its top is 30°. Its height is

A. $42\sqrt{3}$ m **B.** $28\sqrt{3}$ m **C.** $84\sqrt{3}$ m **D.** 42 m

5. From the top of a lighthouse 64 m high, the angle of depression of a ship is 15°. The distance of the ship from the foot of the lighthouse is

A. $64(2-\sqrt{3})$ m **B.** $64(\sqrt{3}+2)$ m
C. $64(\sqrt{6}+\sqrt{2})$ m **D.** $16(\sqrt{6}-\sqrt{2})$ m

6. From the top of a tower 66 m high, the angles of depression of two cars on opposite sides of it, in line with its foot are 45° and 75°. The distance between them is

A. $66(\sqrt{3}+1)$ m **B.** $66(\sqrt{3}+3)$ m
C. $66(\sqrt{3}-1)$ m **D.** $66(3-\sqrt{3})$ m

7. From the top of a cliff 24 m high, the angle of depression of a boat is 30°. The distance of the boat from the foot of the cliff is

A. 48 m **B.** $8\sqrt{3}$ m **C.** $24\sqrt{3}$ m **D.** 12 m

8. Two points 72 m apart lie on opposite sides of a tower, in line with its foot. The top is seen from both at an elevation of 30°. The height of the tower is

A. $36\sqrt{3}\ \text{m}$ **B.** $24\sqrt{3}\ \text{m}$ **C.** $12\sqrt{3}\ \text{m}$ **D.** $72\sqrt{3}\ \text{m}$

9. Two points 18 m apart on level ground lie on opposite sides of a temple gopuram, in line with its foot. The angles of elevation of its top from them are 15° and 75°. Its height is

A. $3\sqrt{3}\ \text{m}$ **B.** $\frac{9}{2}\ \text{m}$ **C.** $9\ \text{m}$ **D.** $36\ \text{m}$

10. Two points 72 m apart on level ground lie on opposite sides of a water tank, in line with its foot. The angles of elevation of its top from them are 60° and 45°. Its height is

A. $36(3-\sqrt{3})\ \text{m}$ **B.** $36(\sqrt{3}+1)\ \text{m}$
C. $36(\sqrt{3}-1)\ \text{m}$ **D.** $36(\sqrt{3}+3)\ \text{m}$

11. The angle of elevation of the top of a chimney from a point on level ground is 15°. After walking 150 m towards it, the angle becomes 60°. The height of the chimney is

A. $75(2\sqrt{3}-3)\ \text{m}$ **B.** $300(\sqrt{3}-1)\ \text{m}$
C. $\frac{75(3-\sqrt{3})}{2}\ \text{m}$ **D.** $100(\sqrt{3}+3)\ \text{m}$

12. The angle of elevation of the top of a building is 60°. After walking 54 m towards it, it is 75°. How far is the observer now from the foot of the building?

A. $54\sqrt{3}\ \text{m}$ **B.** $36(3-\sqrt{3})\ \text{m}$
C. $27\sqrt{3}\ \text{m}$ **D.** $108\ \text{m}$

13. The angle of elevation of the top of a chimney from a point on level ground is 45°. After walking 90 m towards it, the angle becomes 60°. The height of the chimney is

A. $90(\sqrt{3}-1)\ \text{m}$ **B.** $45(3-\sqrt{3})\ \text{m}$
C. $30(3-\sqrt{3})\ \text{m}$ **D.** $45(\sqrt{3}+3)\ \text{m}$

14. From the foot of a building the angle of elevation of the top of a tower is 75°, and from the top of the building, 36 m high, it is 30°. The height of the tower is

A. $9(\sqrt{3}+1)\ \text{m}$ **B.** $9(\sqrt{3}+7)\ \text{m}$
C. $9(\sqrt{3}+3)\ \text{m}$ **D.** $9(\sqrt{3}-1)\ \text{m}$

15. From the foot of a building the angle of elevation of the top of a tower is 75°, and from the top of the building, 96 m high, it is 15°. The height of the tower is

A. $16(2\sqrt{3}-3)\ \text{m}$ **B.** $16(2\sqrt{3}+9)\ \text{m}$
C. $16(2\sqrt{3}+3)\ \text{m}$ **D.** $16\sqrt{3}\ \text{m}$

16. The angle of depression of a point P seen from Q is 49°. The angle of elevation of Q seen from P is

A. 41° **B.** 98° **C.** 131° **D.** 49°

17. A flagstaff 24 m long stands on a tower. From a point on the ground, the angles of elevation of the foot and the top of the flagstaff are 30° and 75°. The height of the tower is

A. $12(\sqrt{3}-1)$ m **B.** $6(\sqrt{3}-1)$ m
C. $6(\sqrt{3}+1)$ m **D.** $6(\sqrt{3}+3)$ m

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18. A flagstaff 12 m long stands on a tower. From a point on the ground, the angles of elevation of the foot and the top of the flagstaff are 15° and 30°. The height of the tower is

A. $6\sqrt{3}$ m **B.** $12\sqrt{3}$ m
C. $6(\sqrt{3}+2)$ m **D.** 6 m

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19. A tower is 33 m high and a flagstaff stands on it. From a point on the ground the elevations of the top of the tower and the top of the flagstaff are 15° and 30°. The length of the flagstaff is

A. $22(2\sqrt{3}-3)$ m **B.** $22\sqrt{3}$ m
C. 66 m **D.** $11(2\sqrt{3}+3)$ m

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20. From a point 120 m above a lake, the angle of elevation of a cloud is 15° and the angle of depression of its reflection is 30°. The height of the cloud above the lake is

A. $120(\sqrt{3}+1)$ m **B.** $120(\sqrt{3}+2)$ m
C. $60(\sqrt{3}-1)$ m **D.** $120\sqrt{3}$ m

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21. From a point 75 m above a lake, the angle of elevation of a cloud is 15° and the angle of depression of its reflection is 60°. The height of the cloud above the lake is

A. $\frac{75(\sqrt{3}-1)}{2}$ m **B.** $75(\sqrt{3}-1)$ m
C. $\frac{75(\sqrt{3}+3)}{2}$ m **D.** $\frac{75(\sqrt{3}+1)}{2}$ m

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22. From P the elevation of the top T of a tower is 30°. Walking up a path inclined at 15° towards the tower to Q, the elevation becomes 45°. In triangle PQT, $\angle TPQ$, at the starting point is

A. 30° **B.** 15° **C.** 165° **D.** 45°

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23. The elevation of the top of a tower from a point is 45°. After walking 21 m up a slope inclined at 30° towards it, the elevation is 60°. The height of the tower is

A. $\frac{21(\sqrt{3}+1)}{2}$ m **B.** $\frac{21(\sqrt{3}+3)}{2}$ m
C. $\frac{21(\sqrt{3}-1)}{2}$ m **D.** $21(\sqrt{3}+1)$ m

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24. In triangle ABC, D is the midpoint of AB, $\angle ACD = 30^\circ$ and $\angle DCB = 75^\circ$. If $\theta = \angle CDB$, then $\cot\theta =$

A. $1-\sqrt{3}$ **B.** $2(\sqrt{3}-1)$ **C.** 1 **D.** $\sqrt{3}-1$

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25. In triangle ABC, D is the midpoint of AB, $A = 15^\circ$ and $B = 75^\circ$. If $\theta = \angle CDB$, then $\cot\theta =$

A. $\sqrt{3}$ **B.** $-\sqrt{3}$ **C.** $2\sqrt{3}$ **D.** 2

Key sheet

1. A	**2.** B	**3.** D	**4.** B	**5.** B
6. D	**7.** C	**8.** C	**9.** B	**10.** A
11. C	**12.** C	**13.** D	**14.** C	**15.** C
16. D	**17.** B	**18.** A	**19.** B	**20.** A
21. D	**22.** B	**23.** A	**24.** D	**25.** A

Solutions

1. From a point 18 m away from the foot of a building, the angle of elevation of its top is 15°. Its height is

$\tan 15^\circ = \frac{h}{18}$

$h = 18\tan 15^\circ = 18 \times (2-\sqrt{3}) = 18(2-\sqrt{3})$ m

Ans: (A) $18(2-\sqrt{3})$ m

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2. A tree is 45 m high. From a point $15\sqrt{3}$ m from its foot, the angle of elevation of its top is

$\tan\theta = \frac{45}{15\sqrt{3}} = \sqrt{3}$

$\theta = 60^\circ$

Ans: (B) 60°

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3. A tree is 120 m high. By how much is its shadow longer when the sun's elevation is 15° than when it is 30°?

Shadow length $= h\cot(\text{elevation})$.

$120\cot 15^\circ - 120\cot 30^\circ = 120((2+\sqrt{3}) - \sqrt{3})$

$= 240$ m

Ans: (D) 240 m

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4. From a point 84 m away from the foot of a chimney, the angle of elevation of its top is 30°. Its height is

$\tan 30^\circ = \frac{h}{84}$

$h = 84\tan 30^\circ = 84 \times \frac{1}{\sqrt{3}} = 28\sqrt{3}$ m

Ans: (B) $28\sqrt{3}$ m

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5. From the top of a lighthouse 64 m high, the angle of depression of a ship is 15°. The distance of the ship from the foot of the lighthouse is

The angle of elevation of the top from the ship is also 15°.

$x = 64\cot 15^\circ = 64 \times (2+\sqrt{3}) = 64(\sqrt{3}+2)$ m

Ans: (B) $64(\sqrt{3}+2)$ m

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6. From the top of a tower 66 m high, the angles of depression of two cars on opposite sides of it, in line with its foot are 45° and 75°. The distance between them is

distances from the foot: $66\cot 45^\circ = 66,\ 66\cot 75^\circ = 66(2-\sqrt{3})$

Opposite sides: add.

distance $= 66(3-\sqrt{3})$ m

Ans: (D) $66(3-\sqrt{3})$ m

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7. From the top of a cliff 24 m high, the angle of depression of a boat is 30°. The distance of the boat from the foot of the cliff is

The angle of elevation of the top from the boat is also 30°.

$x = 24\cot 30^\circ = 24 \times \sqrt{3} = 24\sqrt{3}$ m

Ans: (C) $24\sqrt{3}$ m

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8. Two points 72 m apart lie on opposite sides of a tower, in line with its foot. The top is seen from both at an elevation of 30°. The height of the tower is

The angles are equal, so the foot is midway: each point is 36 m from it.

$h = 36\tan 30^\circ = 12\sqrt{3}\ \text{m}$

Ans: (C) $12\sqrt{3}\ \text{m}$

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9. Two points 18 m apart on level ground lie on opposite sides of a temple gopuram, in line with its foot. The angles of elevation of its top from them are 15° and 75°. Its height is

$h = \frac{d}{\cot\alpha + \cot\beta} = \frac{18}{(2+\sqrt{3})+(2-\sqrt{3})}$

$= \frac{9}{2}\ \text{m}$

Ans: (B) $\frac{9}{2}\ \text{m}$

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10. Two points 72 m apart on level ground lie on opposite sides of a water tank, in line with its foot. The angles of elevation of its top from them are 60° and 45°. Its height is

$h = \frac{d}{\cot\alpha + \cot\beta} = \frac{72}{\frac{1}{\sqrt{3}}+1}$

$= 36(3-\sqrt{3})\ \text{m}$

Ans: (A) $36(3-\sqrt{3})\ \text{m}$

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11. The angle of elevation of the top of a chimney from a point on level ground is 15°. After walking 150 m towards it, the angle becomes 60°. The height of the chimney is

$h\cot 15^\circ - h\cot 60^\circ = 150$

$h = \frac{150}{(2+\sqrt{3})-\frac{1}{\sqrt{3}}} = \frac{75(3-\sqrt{3})}{2}\ \text{m}$

Ans: (C) $\frac{75(3-\sqrt{3})}{2}\ \text{m}$

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12. The angle of elevation of the top of a building is 60°. After walking 54 m towards it, it is 75°. How far is the observer now from the foot of the building?

$h = \frac{54}{\frac{1}{\sqrt{3}}-(2-\sqrt{3})} = 27(2\sqrt{3}+3)$

$\text{distance} = h\cot 75^\circ = 27(2\sqrt{3}+3)\times(2-\sqrt{3}) = 27\sqrt{3}\ \text{m}$

Ans: (C) $27\sqrt{3}\ \text{m}$

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13. The angle of elevation of the top of a chimney from a point on level ground is 45°. After walking 90 m towards it, the angle becomes 60°. The height of the chimney is

$h\cot 45^\circ - h\cot 60^\circ = 90$

$h = \frac{90}{1-\frac{1}{\sqrt{3}}} = 45(\sqrt{3}+3)\ \text{m}$

Ans: (D) $45(\sqrt{3}+3)\ \text{m}$

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14. From the foot of a building the angle of elevation of the top of a tower is 75°, and from the top of the building, 36 m high, it is 30°. The height of the tower is

$h = x\tan 75^\circ,\ h - 36 = x\tan 30^\circ$

$h = \frac{d\cot\alpha}{\cot\alpha - \cot\beta} = \frac{36\times\sqrt{3}}{\sqrt{3}-(2-\sqrt{3})}$

$= 9(\sqrt{3}+3)\ \text{m}$

Ans: (C) $9(\sqrt{3}+3)\ \text{m}$

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15. From the foot of a building the angle of elevation of the top of a tower is 75°, and from the top of the building, 96 m high, it is 15°. The height of the tower is

$h = x\tan 75^\circ,\ h - 96 = x\tan 15^\circ$

$h = \frac{d\cot\alpha}{\cot\alpha - \cot\beta} = \frac{96\times(2+\sqrt{3})}{(2+\sqrt{3})-(2-\sqrt{3})}$

$= 16(2\sqrt{3}+3)\ \text{m}$

Ans: (C) $16(2\sqrt{3}+3)\ \text{m}$

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16. The angle of depression of a point P seen from Q is 49°. The angle of elevation of Q seen from P is

The horizontals through P and Q are parallel; the line PQ makes equal alternate angles with them. So the elevation is 49°.

Ans: (D) 49°

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17. A flagstaff 24 m long stands on a tower. From a point on the ground, the angles of elevation of the foot and the top of the flagstaff are 30° and 75°. The height of the tower is

$h = x\tan 30^\circ,\ h + 24 = x\tan 75^\circ$

$h = \frac{d\cot\beta}{\cot\alpha - \cot\beta} = \frac{24\times(2-\sqrt{3})}{\sqrt{3}-(2-\sqrt{3})}$

$= 6(\sqrt{3}-1)\ \text{m}$

Ans: (B) $6(\sqrt{3}-1)\ \text{m}$

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18. A flagstaff 12 m long stands on a tower. From a point on the ground, the angles of elevation of the foot and the top of the flagstaff are 15° and 30°. The height of the tower is

$h = x\tan 15^\circ,\ h + 12 = x\tan 30^\circ$

$h = \frac{d\cot\beta}{\cot\alpha - \cot\beta} = \frac{12\times\sqrt{3}}{(2+\sqrt{3})-\sqrt{3}}$

$= 6\sqrt{3}\ \text{m}$

Ans: (A) $6\sqrt{3}\ \text{m}$

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19. A tower is 33 m high and a flagstaff stands on it. From a point on the ground the elevations of the top of the tower and the top of the flagstaff are 15° and 30°. The length of the flagstaff is

$x = 33\cot 15^\circ = 33(\sqrt{3}+2)$

$33 + l = x\tan 30^\circ = 33(\sqrt{3}+2)\times\frac{1}{\sqrt{3}} = 11(2\sqrt{3}+3)$

$l = 22\sqrt{3}\ \text{m}$

Ans: (B) $22\sqrt{3}\ \text{m}$

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20. From a point 120 m above a lake, the angle of elevation of a cloud is 15° and the angle of depression of its reflection is 30°. The height of the cloud above the lake is

$h = \frac{d\sin(\beta+\alpha)}{\sin(\beta-\alpha)} = \frac{120\sin 45^\circ}{\sin 15^\circ}$

$= 120(\sqrt{3}+1)\ \text{m}$

Ans: (A) $120(\sqrt{3}+1)\ \text{m}$

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21. From a point 75 m above a lake, the angle of elevation of a cloud is 15° and the angle of depression of its reflection is 60°. The height of the cloud above the lake is

$h = \frac{d\sin(\beta+\alpha)}{\sin(\beta-\alpha)} = \frac{75\sin 75^\circ}{\sin 45^\circ}$

$= \frac{75(\sqrt{3}+1)}{2}$ m

Ans: (D) $\frac{75(\sqrt{3}+1)}{2}$ m

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22. From P the elevation of the top T of a tower is 30°. Walking up a path inclined at 15° towards the tower to Q, the elevation becomes 45°. In triangle PQT, $\angle TPQ$, at the starting point is

The angle at P is $\alpha - \beta$.

$= 15^\circ$

Ans: (B) 15°

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23. The elevation of the top of a tower from a point is 45°. After walking 21 m up a slope inclined at 30° towards it, the elevation is 60°. The height of the tower is

$h = \frac{d\sin(\gamma-\beta)\sin\alpha}{\sin(\gamma-\alpha)} = \frac{21\sin 30^\circ \sin 45^\circ}{\sin 15^\circ}$

$= \frac{21(\sqrt{3}+1)}{2}$ m

Ans: (A) $\frac{21(\sqrt{3}+1)}{2}$ m

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24. In triangle ABC, D is the midpoint of AB, $\angle ACD = 30^\circ$ and $\angle DCB = 75^\circ$. If $\theta = \angle CDB$, then $\cot\theta =$

$(m+n)\cot\theta = m\cot\alpha - n\cot\beta,\ m = n = 1$

$2\cot\theta = \sqrt{3} - (2-\sqrt{3}) \Rightarrow \cot\theta = \sqrt{3} - 1$

Ans: (D) $\sqrt{3} - 1$

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25. In triangle ABC, D is the midpoint of AB, $A = 15^\circ$ and $B = 75^\circ$. If $\theta = \angle CDB$, then $\cot\theta =$

$(m+n)\cot\theta = n\cot A - m\cot B,\ m = n = 1$

$2\cot\theta = (2+\sqrt{3}) - (2-\sqrt{3}) \Rightarrow \cot\theta = \sqrt{3}$

Ans: (A) $\sqrt{3}$
