EXPRESSWALA ACADEMY

# Maths 1A: Heights and Distances

## MCQ Test, Set 07

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 $25$ m away from the foot of a chimney, the angle of elevation of its top is $30^\circ$. Its height is

**A.** $25\sqrt{3}$ m **B.** $\frac{25}{2}$ m
**C.** $\frac{25\sqrt{3}}{3}$ m **D.** $\frac{25\sqrt{3}}{2}$ m

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

**A.** $45^\circ$ **B.** $30^\circ$ **C.** $60^\circ$ **D.** $75^\circ$

**3.** A tower is $25$ m high. By how much is its shadow longer when the sun's elevation is $60^\circ$ than when it is $75^\circ$?

**A.** $\frac{50(2\sqrt{3}-3)}{3}$ m **B.** $\frac{50(3-\sqrt{3})}{3}$ m
**C.** $50$ m **D.** $\frac{25(2\sqrt{3}+3)}{2}$ m

**4.** From a point $96$ m away from the foot of a chimney, the angle of elevation of its top is $30^\circ$. Its height is

**A.** $48$ m **B.** $96\sqrt{3}$ m **C.** $32\sqrt{3}$ m **D.** $48\sqrt{3}$ m

**5.** From the top of a tower $18$ m high, the angle of depression of a car is $15^\circ$. The distance of the car from the foot of the tower is

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

**6.** From the top of a cliff $33$ m high, the angles of depression of two boats on opposite sides of it, in line with its foot are $60^\circ$ and $75^\circ$. The distance between them is

**A.** $22(3-\sqrt{3})$ m **B.** $66(\sqrt{3}+1)$ m
**C.** $22(2\sqrt{3}-3)$ m **D.** $66$ m

**7.** From the top of a bridge $21$ m high, the angle of depression of a boat is $30^\circ$. The distance of the boat from the foot of the bridge is

**A.** $42$ m **B.** $7\sqrt{3}$ m **C.** $21\sqrt{3}$ m **D.** $\frac{21}{2}$ m

**8.** Two points $192$ m apart lie on opposite sides of a tower, in line with its foot. The top is seen from both at an elevation of $30^\circ$. The height of the tower is

**A.** $64\sqrt{3}\ \text{m}$ **B.** $192\sqrt{3}\ \text{m}$ **C.** $96\sqrt{3}\ \text{m}$ **D.** $32\sqrt{3}\ \text{m}$

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**9.** Two points $42$ m apart on level ground lie on opposite sides of a tree, in line with its foot. The angles of elevation of its top from them are $30^\circ$ and $75^\circ$. Its height is

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

**C.** $21(2\sqrt{3}-3)\ \text{m}$ **D.** $14(2\sqrt{3}+3)\ \text{m}$

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**10.** Two points $150$ 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 $30^\circ$ and $75^\circ$. Its height is

**A.** $50(2\sqrt{3}+3)\ \text{m}$ **B.** $75\ \text{m}$

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

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**11.** The angle of elevation of the top of a chimney from a point on level ground is $30^\circ$. After walking $30$ m towards it, the angle becomes $45^\circ$. The height of the chimney is

**A.** $15(\sqrt{3}+1)\ \text{m}$ **B.** $30(\sqrt{3}-1)\ \text{m}$

**C.** $15(\sqrt{3}-1)\ \text{m}$ **D.** $10(3-\sqrt{3})\ \text{m}$

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**12.** The angle of elevation of the top of a building is $45^\circ$. After walking $48$ m towards it, it is $60^\circ$. How far is the observer now from the foot of the building?

**A.** $24(\sqrt{3}+1)\ \text{m}$ **B.** $48(\sqrt{3}-1)\ \text{m}$

**C.** $16(\sqrt{3}+3)\ \text{m}$ **D.** $48(\sqrt{3}+1)\ \text{m}$

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**13.** The angle of elevation of the top of a water tank from a point on level ground is $30^\circ$. After walking $75$ m towards it, the angle becomes $45^\circ$. The height of the water tank is

**A.** $25(3-\sqrt{3})\ \text{m}$ **B.** $75(\sqrt{3}-1)\ \text{m}$

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

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**14.** From the foot of a building the angle of elevation of the top of a tower is $75^\circ$, and from the top of the building, $150$ m high, it is $15^\circ$. The height of the tower is

**A.** $25\sqrt{3}\ \text{m}$ **B.** $25(2\sqrt{3}-3)\ \text{m}$

**C.** $25(2\sqrt{3}+3)\ \text{m}$ **D.** $25(2\sqrt{3}+9)\ \text{m}$

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**15.** From the foot of a building the angle of elevation of the top of a tower is $75^\circ$, and from the top of the building, $90$ m high, it is $60^\circ$. The height of the tower is

**A.** $45\sqrt{3}\ \text{m}$ **B.** $45(\sqrt{3}+2)\ \text{m}$

**C.** $45(\sqrt{3}+4)\ \text{m}$ **D.** $45(2\sqrt{3}+3)\ \text{m}$

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**16.** The angle of depression of a point $P$ seen from $Q$ is $13^\circ$. The angle of elevation of $Q$ seen from $P$ is

**A.** $26^\circ$ **B.** $77^\circ$ **C.** $167^\circ$ **D.** $13^\circ$

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**17.** A flagstaff $15$ 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 $60^\circ$ and $75^\circ$. The height of the tower is

**A.** $\frac{15(2\sqrt{3}+3)}{2}\ \text{m}$ **B.** $15\sqrt{3}\ \text{m}$

**C.** $\frac{15(\sqrt{3}+2)}{2}\ \text{m}$ **D.** $\frac{15\sqrt{3}}{2}\ \text{m}$

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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 $15^\circ$ and $75^\circ$. The height of the tower is

**A.** $2(2\sqrt{3}-3)\ \text{m}$ **B.** $2\sqrt{3}\ \text{m}$

**C.** $2(2\sqrt{3}+3)\ \text{m}$ **D.** $4(2\sqrt{3}-3)\ \text{m}$

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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 $15^\circ$ and $45^\circ$. The length of the flagstaff is

**A.** $33(\sqrt{3}+1)\ \text{m}$ **B.** $33(\sqrt{3}-1)\ \text{m}$

**C.** $66(\sqrt{3}+1)\ \text{m}$ **D.** $33(\sqrt{3}+2)\ \text{m}$

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**20.** From a point $45$ m above a lake, the angle of elevation of a cloud is $45^\circ$ and the angle of depression of its reflection is $60^\circ$. The height of the cloud above the lake is

**A.** $45(\sqrt{3}+3)\ \text{m}$ **B.** $45(2-\sqrt{3})\ \text{m}$

**C.** $45(\sqrt{3}+1)\ \text{m}$ **D.** $45(\sqrt{3}+2)\ \text{m}$

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**21.** From a point $150$ m above a lake, the angle of elevation of a cloud is $15^\circ$ and the angle of depression of its reflection is $75^\circ$. The height of the cloud above the lake is

**A.** $75\sqrt{3}\ \text{m}$ **B.** $100\sqrt{3}\ \text{m}$

**C.** $50(2\sqrt{3}+3)\ \text{m}$ **D.** $50(2\sqrt{3}-3)\ \text{m}$

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**22.** From $P$ the elevation of the top $T$ of a tower is $45^\circ$. Walking up a path inclined at $30^\circ$ towards the tower to $Q$, the elevation becomes $75^\circ$. In triangle $PQT$, $\angle PTQ$, at the top of the tower is

**A.** $75^\circ$ **B.** $150^\circ$ **C.** $45^\circ$ **D.** $30^\circ$

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**23.** The elevation of the top of a tower from a point is $60^\circ$. After walking $96$ m up a slope inclined at $30^\circ$ towards it, the elevation is $75^\circ$. The height of the tower is

**A.** $96(\sqrt{3}+3)\ \text{m}$ **B.** $48(2\sqrt{3}+3)\ \text{m}$

**C.** $24(3-\sqrt{3})\ \text{m}$ **D.** $48(\sqrt{3}+3)\ \text{m}$

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**24.** In triangle $ABC$, $D$ is the midpoint of $AB$, $\angle ACD = 15^\circ$ and $\angle DCB = 30^\circ$. If $\theta = \angle CDB$, then $\cot\theta =$

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

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**25.** In triangle $ABC$, $D$ is the midpoint of $AB$, $A = 60^\circ$ and $B = 15^\circ$. If $\theta = \angle CDB$, then $\cot\theta =$

**A.** $\frac{-2(\sqrt{3}+3)}{3}$ **B.** $\frac{-(\sqrt{3}+3)}{3}$

**C.** $\frac{2\sqrt{3}+3}{3}$ **D.** $\frac{\sqrt{3}+3}{3}$

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## Key sheet

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

## Solutions

**1.** From a point $25$ m away from the foot of a chimney, the angle of elevation of its top is $30^\circ$. Its height is

$\tan 30^\circ = \frac{h}{25}$

$h = 25\tan 30^\circ = 25 \times \frac{1}{\sqrt{3}} = \frac{25\sqrt{3}}{3}$ m

**Ans: (C)** $\frac{25\sqrt{3}}{3}$ m

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**2.** A minar 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: (C)** $60^\circ$

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**3.** A tower is $25$ m high. By how much is its shadow longer when the sun's elevation is $60^\circ$ than when it is $75^\circ$?

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

$25\cot 60^\circ - 25\cot 75^\circ = 25(\frac{1}{\sqrt{3}} - (2-\sqrt{3}))$

$= \frac{50(2\sqrt{3}-3)}{3}$ m

**Ans: (A)** $\frac{50(2\sqrt{3}-3)}{3}$ m

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**4.** From a point $96$ m away from the foot of a chimney, the angle of elevation of its top is $30^\circ$. Its height is

$\tan 30^\circ = \frac{h}{96}$

$h = 96\tan 30^\circ = 96 \times \frac{1}{\sqrt{3}} = 32\sqrt{3}$ m

**Ans: (C)** $32\sqrt{3}$ m

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**5.** From the top of a tower $18$ m high, the angle of depression of a car is $15^\circ$. The distance of the car from the foot of the tower is

The angle of elevation of the top from the car is also $15^\circ$.

$x = 18\cot 15^\circ = 18 \times (2+\sqrt{3}) = 18(\sqrt{3}+2)$ m

**Ans: (B)** $18(\sqrt{3}+2)$ m

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**6.** From the top of a cliff $33$ m high, the angles of depression of two boats on opposite sides of it, in line with its foot are $60^\circ$ and $75^\circ$. The distance between them is

distances from the foot: $33\cot 60^\circ = 11\sqrt{3},\ 33\cot 75^\circ = 33(2-\sqrt{3})$

Opposite sides: add.

$\text{distance} = 22(3-\sqrt{3})$ m

**Ans: (A)** $22(3-\sqrt{3})$ m

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**7.** From the top of a bridge $21$ m high, the angle of depression of a boat is $30^\circ$. The distance of the boat from the foot of the bridge is

The angle of elevation of the top from the boat is also $30^\circ$.

$x = 21\cot 30^\circ = 21 \times \sqrt{3} = 21\sqrt{3}$ m

**Ans: (C)** $21\sqrt{3}$ m

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**8.** Two points $192$ m apart lie on opposite sides of a tower, in line with its foot. The top is seen from both at an elevation of $30^\circ$. The height of the tower is

The angles are equal, so the foot is midway: each point is $96$ m from it.

$h = 96\tan 30^\circ = 32\sqrt{3}\ \text{m}$

**Ans: (D)** $32\sqrt{3}\ \text{m}$

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**9.** Two points $42$ m apart on level ground lie on opposite sides of a tree, in line with its foot. The angles of elevation of its top from them are $30^\circ$ and $75^\circ$. Its height is

$h = \frac{d}{\cot\alpha + \cot\beta} = \frac{42}{\sqrt{3}+(2-\sqrt{3})}$

$= 21\ \text{m}$

**Ans: (B)** $21\ \text{m}$

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**10.** Two points $150$ 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 $30^\circ$ and $75^\circ$. Its height is

$h = \frac{d}{\cot\alpha + \cot\beta} = \frac{150}{\sqrt{3}+(2-\sqrt{3})}$

$= 75\ \text{m}$

**Ans: (B)** $75\ \text{m}$

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**11.** The angle of elevation of the top of a chimney from a point on level ground is $30^\circ$. After walking $30$ m towards it, the angle becomes $45^\circ$. The height of the chimney is

$h\cot 30^\circ - h\cot 45^\circ = 30$

$h = \frac{30}{\sqrt{3}-1} = 15(\sqrt{3}+1)\ \text{m}$

**Ans: (A)** $15(\sqrt{3}+1)\ \text{m}$

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**12.** The angle of elevation of the top of a building is $45^\circ$. After walking $48$ m towards it, it is $60^\circ$. How far is the observer now from the foot of the building?

$h = \frac{48}{1-\frac{1}{\sqrt{3}}} = 24(\sqrt{3}+3)$

$\text{distance} = h\cot 60^\circ = 24(\sqrt{3}+3)\times\frac{1}{\sqrt{3}} = 24(\sqrt{3}+1)\ \text{m}$

**Ans: (A)** $24(\sqrt{3}+1)\ \text{m}$

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**13.** The angle of elevation of the top of a water tank from a point on level ground is $30^\circ$. After walking $75$ m towards it, the angle becomes $45^\circ$. The height of the water tank is

$h\cot 30^\circ - h\cot 45^\circ = 75$

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

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

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**14.** From the foot of a building the angle of elevation of the top of a tower is $75^\circ$, and from the top of the building, $150$ m high, it is $15^\circ$. The height of the tower is

$h = x\tan 75^\circ,\ h - 150 = x\tan 15^\circ$

$h = \frac{d\cot\alpha}{\cot\alpha - \cot\beta} = \frac{150\times(2+\sqrt{3})}{(2+\sqrt{3})-(2-\sqrt{3})}$

$= 25(2\sqrt{3}+3)\ \text{m}$

**Ans: (C)** $25(2\sqrt{3}+3)\ \text{m}$

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**15.** From the foot of a building the angle of elevation of the top of a tower is $75^\circ$, and from the top of the building, $90$ m high, it is $60^\circ$. The height of the tower is

$h = x\tan 75^\circ,\ h - 90 = x\tan 60^\circ$

$h = \frac{d\cot\alpha}{\cot\alpha - \cot\beta} = \frac{90\times\frac{1}{\sqrt{3}}}{\frac{1}{\sqrt{3}} - (2-\sqrt{3})}$

$= 45(\sqrt{3}+2)\ \text{m}$

**Ans: (B)** $45(\sqrt{3}+2)\ \text{m}$

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**16.** The angle of depression of a point $P$ seen from $Q$ is $13^\circ$. 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 $13^\circ$.

**Ans: (D)** $13^\circ$

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**17.** A flagstaff $15$ 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 $60^\circ$ and $75^\circ$. The height of the tower is

$h = x\tan 60^\circ,\ h + 15 = x\tan 75^\circ$

$h = \frac{d\cot\beta}{\cot\alpha - \cot\beta} = \frac{15\times(2-\sqrt{3})}{\frac{1}{\sqrt{3}} - (2-\sqrt{3})}$

$= \frac{15\sqrt{3}}{2}\ \text{m}$

**Ans: (D)** $\frac{15\sqrt{3}}{2}\ \text{m}$

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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 $15^\circ$ and $75^\circ$. The height of the tower is

$h = x\tan 15^\circ,\ h + 12 = x\tan 75^\circ$

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

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

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

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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 $15^\circ$ and $45^\circ$. The length of the flagstaff is

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

$33 + l = x\tan 45^\circ = 33(\sqrt{3}+2)\times 1 = 33(\sqrt{3}+2)$

$l = 33(\sqrt{3}+1)\ \text{m}$

**Ans: (A)** $33(\sqrt{3}+1)\ \text{m}$

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**20.** From a point $45$ m above a lake, the angle of elevation of a cloud is $45^\circ$ and the angle of depression of its reflection is $60^\circ$. The height of the cloud above the lake is

$h = \frac{d\sin(\beta+\alpha)}{\sin(\beta-\alpha)} = \frac{45\sin 105^\circ}{\sin 15^\circ}$

$= 45(\sqrt{3}+2)\ \text{m}$

**Ans: (D)** $45(\sqrt{3}+2)\ \text{m}$

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**21.** From a point $150$ m above a lake, the angle of elevation of a cloud is $15^\circ$ and the angle of depression of its reflection is $75^\circ$. The height of the cloud above the lake is

$h = \frac{d\sin(\beta+\alpha)}{\sin(\beta-\alpha)} = \frac{150\sin 90^\circ}{\sin 60^\circ}$

$= 100\sqrt{3}\ \text{m}$

**Ans: (B)** $100\sqrt{3}\ \text{m}$

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**22.** From $P$ the elevation of the top $T$ of a tower is $45^\circ$. Walking up a path inclined at $30^\circ$ towards the tower to $Q$, the elevation becomes $75^\circ$. In triangle $PQT$, $\angle PTQ$, at the top of the tower is

The angle at $T$ is $\gamma - \alpha$.

$= 30^\circ$

**Ans: (D)** $30^\circ$

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**23.** The elevation of the top of a tower from a point is $60^\circ$. After walking $96$ m up a slope inclined at $30^\circ$ towards it, the elevation is $75^\circ$. The height of the tower is

$h = \frac{d\sin(\gamma-\beta)\sin\alpha}{\sin(\gamma-\alpha)} = \frac{96\sin 45^\circ \sin 60^\circ}{\sin 15^\circ}$

$= 48(\sqrt{3}+3)\ \text{m}$

**Ans: (D)** $48(\sqrt{3}+3)\ \text{m}$

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**24.** In triangle $ABC$, $D$ is the midpoint of $AB$, $\angle ACD = 15^\circ$ and $\angle DCB = 30^\circ$. If $\theta = \angle CDB$, then $\cot\theta =$

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

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

**Ans: (C)** $1$

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**25.** In triangle $ABC$, $D$ is the midpoint of $AB$, $A = 60^\circ$ and $B = 15^\circ$. If $\theta = \angle CDB$, then $\cot\theta =$

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

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

**Ans: (B)** $\frac{-(\sqrt{3}+3)}{3}$

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