1. The angle of elevation of the top of a flag post from a point on the ground level 40m away from the flag post is 60°. Find the height of the post.

We can solve this problem using trigonometry. We are given the angle of elevation (60°) and the distance from the flag post (40 meters). We need to find the height of the flag post, which we can label as h.

Step 1: Set up the right triangle

In this case, we have a right triangle, where:

- The angle of elevation is 60°.
- The base of the triangle (horizontal distance from the point of observation to the base of the flag post) is 40 meters.
- The height of the flag post is h, which is the vertical side of the triangle.

We can use the tangent function, as it relates the opposite side (height h) to the adjacent side (distance of 40 meters):

$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$$

Substituting the known values:

$$\tan(60^\circ) = \frac{h}{40}$$

Step 2: Solve for h

We know that $\tan(60^\circ) = \sqrt{3}$, so:

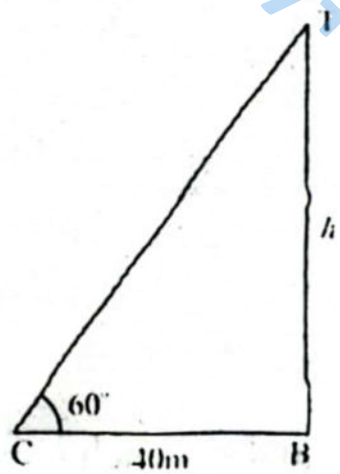
$$\sqrt{3} = \frac{h}{40}$$

Now, solve for h:

$$h = 40 \times \sqrt{3}$$

$$h \approx 40 \times 1.732$$

$$h \approx 69.28\,\text{m}$$

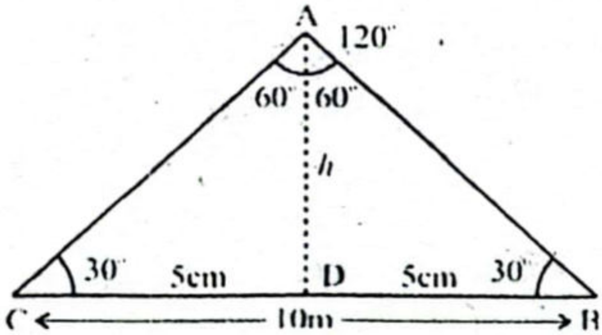


Final Answer:

The height of the flag post is approximately **69.28 meters.**

2. **An isosceles triangle bas a vertical angle of 120° and a base 10cm long. Find the length of its altitude.**

To solve this problem, we'll first break down the isosceles triangle's geometry and use trigonometry to find the length of the altitude.



Given:

- The vertical angle $\angle A = 120°$.
- The length of the base $BC = 10$ cm.
- The triangle is isosceles, meaning the two legs AB and AC are equal in length.
- We need to find the length of the altitude from vertex A to base BC.

Step 1: Understanding the Triangle

Let's label the vertices of the triangle as A, B, and C, with the base BC being 10 cm.

Since the triangle is isosceles, the altitude from vertex A to the base BC will bisect BC into two equal segments. So, the two halves of the base will each have a length of $\frac{10}{2} = 5$ cm.

This forms two right-angled triangles, where:

- The vertical altitude from A to BC is the height h.
- The base of each right triangle is 5 cm.
- The angle at A in each of the right triangles is 60°, since the vertical angle is 120° and the two base angles are equal, so each is $\frac{180° - 120}{2} = 30°$.

Step 2: Use Trigonometry to Find the Altitude

In one of the right triangles, we can use the tangent function, since it relates the opposite side (altitude h) and the adjacent side (half the base, which is 5 cm).

$$\tan(30^\circ) = \frac{h}{5}$$

We know that $\tan(30^\circ) = \frac{1}{\sqrt{3}}$ so:

$$\therefore \quad \frac{h}{5} = \frac{1}{\sqrt{3}}$$

Solving for h:

$$h = \frac{5}{\sqrt{3}}$$

$$h = 2.89$$

Step 3: Diagram of the Triangle

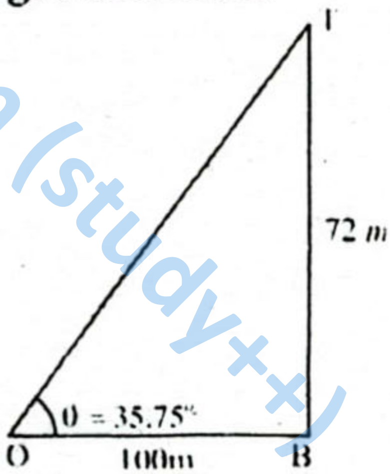
Here's a simple representation of the isosceles triangle:

Final Answer:

- The length of the altitude is approximately **2.89 cm.**

3. **A tree is 72m high. Find the angle of elevation of its top from a point 100m away on the ground level.**

To solve this, we can use trigonometry, specifically the tangent function, since we are given the height of the tree and the distance from the point of observation.



Given:

- Height of the tree $h = 72$ m.
- Distance from the point of observation to the base of the tree $d = 100$ m.

We need to find the angle of elevation θ.

Step 1: Using the Tangent Function

In a right-angled triangle, the tangent of the angle of elevation is given by:

$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$$

Here, the opposite side is the height of the tree $h = 72$ m and the adjacent side is the horizontal distance from the observer to the tree $d = 100$ m.
Thus, we have:

$$\tan(\theta) = \frac{72}{100}$$
$$\tan(\theta) = 0.72$$

Step 2: Finding the Angle θ
To find the angle, take the inverse tangent (also called arctangent):

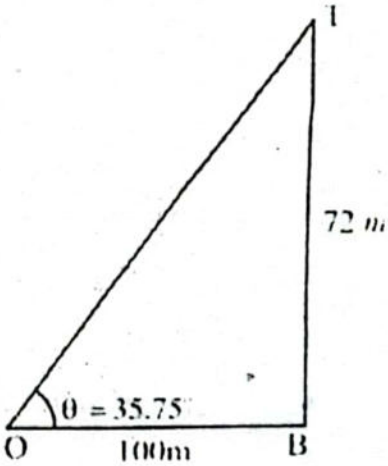
$$\theta = \tan^{-1}(0.72)$$

Using a calculator:

$$\theta \approx 35.75°$$

Final Answer:
The angle of elevation is approximately **35.75°**.

Diagram:
Here is a simple diagram representing the situation:



Where:

- T is the top of the tree,
- B is the base of the tree,
- The height of the tree is 72 meters,
- The distance from the point of observation to the tree's base is 100 meters, and
- The angle θ of elevation from the point on the ground to the top of the tree is approximately 35.75°.

4. **A ladder makes an angle of 60° with the ground and reaches a height of 10m along the wall. Find the length of the ladder.**

To find the length of the ladder, we can use trigonometry. The situation forms a right triangle, where:

- The height of the ladder along the wall is the opposite side to the angle.
- The length of the ladder is the hypotenuse.

- The angle between the ladder and the ground is 60°.

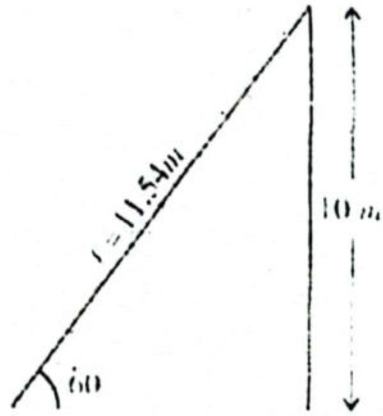
Given:

- The angle of elevation of the ladder, $\theta = 60°$.
- The height of the ladder along the wall (opposite side), $h = 10$ m.

We need to find the length of the ladder, which is the hypotenuse L.

Step 1: Using the Sine Function

The sine of the angle of elevation is related to the opposite side and the hypotenuse by the formula:



$$\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$$

Substitute the known values:

$$\sin(60°) = \frac{10}{L}$$

Step 2: Solve for L

We know that $\sin(60°) = \frac{\sqrt{3}}{2}$, so:

$$\frac{\sqrt{3}}{2} = \frac{10}{L}$$

Multiply both sides by L to solve for L:

$$L = \frac{10}{\frac{\sqrt{3}}{2}} = 10 \times \frac{2}{\sqrt{3}} = \frac{20}{\sqrt{3}}$$

To rationalize the denominator:

$$L = \frac{20}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{20\sqrt{3}}{3}$$

Thus, the length of the ladder is:

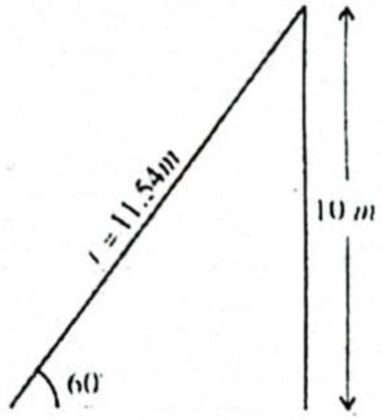
$L \approx 11.54$ m (after simplifying the expression).

Final Answer:

The length of the ladder is approximately **11.54 meters**.

Diagram:

Here is a diagram to represent the situation:



In the diagram:

- The ladder makes an angle of 60° with the ground,
- The height along the wall is 10 meters,
- The length of the ladder is approximately 11.54 meters.

5. A light house tower is 150m high from the sea level. The angle of depression from the top of the tower to a ship is 60°. Find the distance between the ship and the tower.

To solve this problem, we can use trigonometry. The situation forms a right triangle, where:

- The height of the lighthouse is the vertical side of the triangle (opposite side to the angle).
- The distance from the ship to the base of the lighthouse is the horizontal side (adjacent side to the angle).
- The angle of depression is 60° from the top of the tower to the ship.

Given:

- Height of the lighthouse, $h = 150$ m.
- Angle of depression from the top of the tower to the ship, $\theta = 60°$.

We need to find the distance between the ship and the tower, which is the horizontal side of the triangle.

Step 1: Using the Tangent Function

The tangent of the angle of depression is related to the opposite side and the adjacent side by the formula:

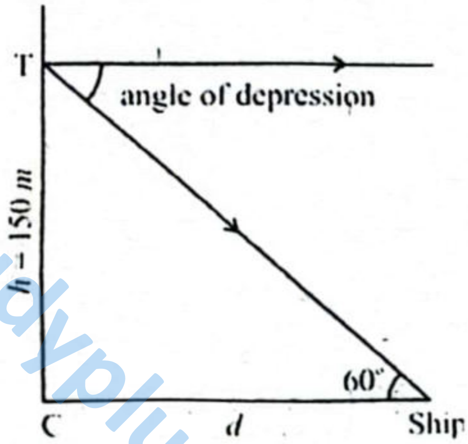
$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$$

In this case:

- The opposite side is the height of the lighthouse, $h = 150\,\text{m}$,
- The adjacent side is the distance between the ship and the base of the tower (let this be d).

Thus, we can write:

$$\tan(60^\circ) = \frac{150}{d}$$



Step 2: Solve for *d*

We know that $\tan(60^\circ) = \sqrt{3}$, so:

$$\sqrt{3} = \frac{150}{d}$$

Rearrange to solve for d:

$$d = \frac{150}{\sqrt{3}} = \frac{150 \times \sqrt{3}}{3} = 50\sqrt{3}$$

Now, calculate d:

$$d \approx 50 \times 1.732 = 86.6\,\text{m}$$

Final Answer:

The distance between the ship and the tower is approximately **86.6 meters.**

Diagram:

Here is a diagram to represent the situation:

In the diagram:

- The lighthouse is 150 meters tall,
- The angle of depression from the top of the tower to the ship is 60°,
- The distance between the ship and the tower is approximately 86.6 meters.

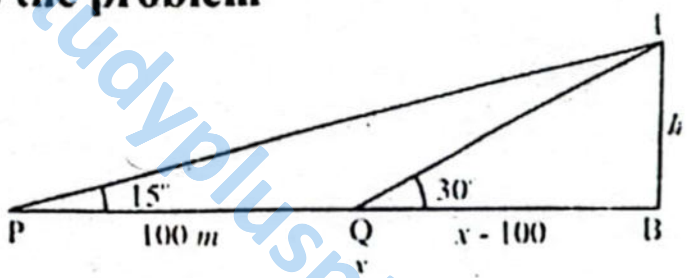
6. **Measure of an angle of elevation of the top of a pole is 15° from a point on the ground, in walking 100m towards the pole the measure of angle is found to be 30°. Find the height of the pole.**

We can solve this problem using trigonometry. Here's a step-by-step solution:

Given:

- Angle of elevation from the first point (at distance x from the pole): 15°
- Angle of elevation from the second point (100 meters closer to the pole): 30°
- The horizontal distance between the two points is 100 meters.

Step 1: Set up the problem



Let:

- h be the height of the pole.
- x be the distance from the first point (where the angle of elevation is 15°) to the base of the pole.
- The second point is 100 meters closer, so the distance from the second point to the pole is $x - 100$.

Step 2: Use trigonometry

We can use the tangent of the angles of elevation for both points to set up two equations.

- From the first point, the angle of elevation is 15°, so:

$$\tan(15°) = \frac{h}{x}$$

2. From the second point, the angle of elevation is 30°, so:

$$\tan(30°) = \frac{h}{x - 100}$$

Step 3: Substitute the values of the tangents

We know the following trigonometric values:

- $\tan(15°) \approx 0.2679$
- $\tan(30°) = \frac{1}{\sqrt{3}} \approx 0.5774$

Substitute these into the equations:

- $0.2679 = \frac{h}{x}$

$$h = 0.2679 \cdot x$$

2. $0.5774 = \frac{h}{x-100}$

$$h = 0.5774 \cdot (x - 100)$$

Step 4: Set up a system of equations

Now, equate the two expressions for h:

$$0.2679 \cdot x = 0.5774 \cdot (x - 100)$$

Step 5: Solve for x

Expand both sides:

$$0.2679 \cdot x = 0.5774 \cdot x - 57.74$$

Move all terms involving x to one side:

$$0.5774 \cdot x - 0.2679 \cdot x = 57.74$$
$$0.3095 \cdot x = 57.74$$

Now solve for x:

$$x = \frac{57.74}{0.3095} \approx 186.6\,\text{m}$$

Step 6: Find the height h

Substitute $x = 186.3$ into the first equation for h:

$$h = 0.2679 \times 186.3 \approx 50\,\text{m}$$

Final Answer:

The height of the pole is approximately **49.9 meters**.

Diagram:

Here is a diagram to represent the situation:

In the diagram:

- The first point is 186.3 meters from the base of the pole.
- The second point is 100 meters closer, at a distance of $186.3 - 100 = 86.3$ meters.
- The height of the pole is approximately 49.9 meters.

7. **Find the measure of an angle of elevation of the Sun, if a tower 300m high casts a shadow 450mm long.**

To find the angle of elevation of the Sun, we can use basic trigonometry. The situation described forms a right triangle, where:

- The height of the tower is 300 meters.
- The length of the shadow is 450 meters.
- The angle of elevation is the angle between the ground and the line of sight from the top of the tower to the Sun.

Step 1: Use the tangent function

In a right triangle, the tangent of the angle of elevation (θ) is given by:

$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$$

Here:

- The opposite side is the height of the tower, which is 300 meters.
- The adjacent side is the length of the shadow, which is 450 meters.

Thus:

$$\tan(\theta) = \frac{300}{450} = \frac{2}{3}$$

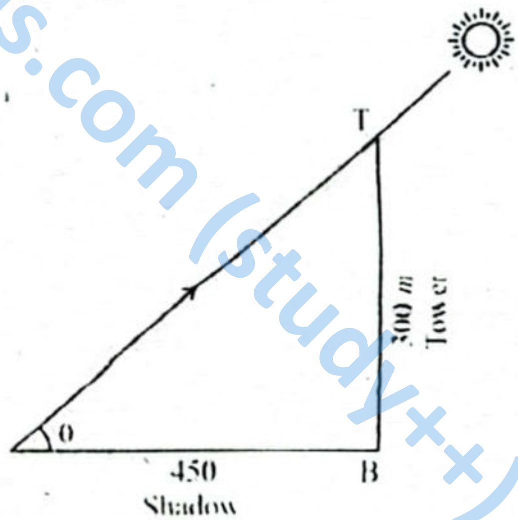
Step 2: Find the angle

Now, to find the angle of elevation (θ), take the inverse tangent (or arctan) of $\frac{2}{3}$:

$$\theta = \tan^{-1}\left(\frac{2}{3}\right)$$

Using a calculator:

$\theta \approx 33.69°$



Final Answer:

The angle of elevation of the Sun is approximately **33.69°**.

Diagram:

Here is a simple diagram to represent the situation:

- The vertical line represents the height of the tower (300m).
- The horizontal line represents the shadow (450m).
- The angle of elevation θ between the ground and the line of sight to the Sun is approximately **33.69°**.

8. **Measure of angle of elevation of the top of a cliff is 25°, on walking 100 metres towards the cliff, measure of angle of elevation of the top is 45°. Find the height of the cliff.**

To find the height of the cliff, we can solve this problem using trigonometry. The situation involves two points from which we are observing the top of the cliff:

- Initially, the angle of elevation from the first point is 25°.
- After walking 100 meters towards the cliff, the angle of elevation increases to 45°.

Let's define the following variables:

- h = height of the cliff (which we need to find)
- x = horizontal distance from the first point to the base of the cliff.
- The second point is 100 meters closer to the cliff, so the horizontal distance from the second point to the base of the cliff is $x - 100$.

Step 1: Use the tangent function for both situations

For the first point, we know:

$$\tan(25°) = \frac{h}{x} \quad \text{....}(i)$$

So,
$$h = x \cdot \tan(25°) \quad \text{(Equation 1)}$$

For the second point, after walking 100 meters closer to the cliff:

$$\tan(45°) = \frac{h}{x - 100} \quad \text{....}(ii)$$

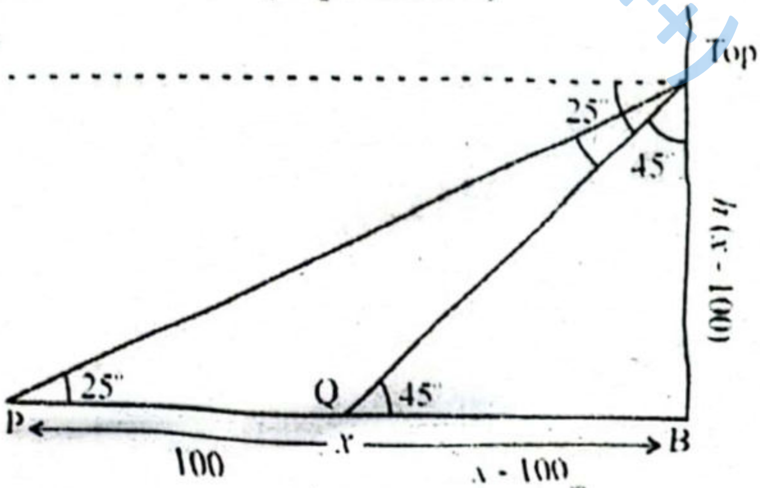
Since $\tan(45°) = 1$, we have:

$$h = x - 100 \quad \text{(Equation 2)}$$

Step 2: Solve the system of equations

Now we have two equations:

- $h = x \cdot \tan(25°)$
- $h = x - 100$



Set the two expressions for h equal to each other:

$$x \cdot \tan(25°) = x - 100$$

Now, solve for x:

$$x \cdot \tan(25°) - x = -100$$

Factor out x:

$$x(\tan(25°) - 1) = -100$$

Now, solve for x:

$$x = \frac{-100}{\tan(25°) - 1}$$

Using a calculator:

$$\tan(25°) \approx 0.4663$$

Thus,

$$x = \frac{-100}{0.4663 - 1} = \frac{-100}{-0.5337} \approx 187.3 \text{ meters}$$

Step 3: Find the height of the cliff

Now that we have the value of x, substitute it into Equation 2 to find the height of the cliff:

$$h = x - 100 = 187.3 - 100 = 87.3 \text{ meters}$$

Final Answer:

The height of the cliff is approximately **87.3 meters.**

Diagram:

- The first line represents the initial position where the angle of elevation is 25°.
- The second line represents the position after walking 100 meters, where the angle of elevation is 45°.
- The height of the cliff is $h \approx 87.3$ meters.

9. From the top of a hill 300m high, the measure of the angle of depression of a point on the nearer shore of the river is 70° and measure of the angle of depression of a point, directly across the river is 50°. Find the width of the river How far is the river from the foot of the hill?

This is a trigonometric problem involving two angles of depression from the top of a hill to two points: one on the nearer ...re of the river and one directly across the river. Let's solve this step by step.

Given:

- Height of the hill, $h = 300$ m

- Angle of depression to the nearer shore, $\theta_1 = 70°$
- Angle of depression to the point directly across the river, $\theta_2 = 50°$

We are asked to find:

- The **width of the river**.
- The **distance from the river to the foot of the hill**.

Step 1: Define variables and use trigonometry

Let's define the following variables:

- Let d_1 be the horizontal distance from the foot of the hill to the nearer shore of the river.
- Let d_2 be the horizontal distance from the foot of the hill to the point directly across the river.
- The width of the river, W, will be the difference between d_2 and d_1:

$$W = d_2 - d_1$$

Step 2: Use the tangent function for both angles of depression

The tangent of an angle of depression relates the height of the hill to the horizontal distance. Specifically, for any angle of depression θ, we can use the formula:

$$\tan(\theta) = \frac{h}{d}$$

<u>FOR THE NEARER SHORE (DISTANCE d_1):</u>

$$\tan(70°) = \frac{300}{d_1}$$

Solving for d_1:

$$d_1 = \frac{300}{\tan(70°)}$$

Using $\tan(70°) \approx 2.747$:

$$d_1 = \frac{300}{2.747} \approx 109.2\,\text{m}$$

<u>FOR THE POINT DIRECTLY ACROSS THE RIVER (DISTANCE d_2):</u>

$$\tan(50°) = \frac{300}{d_2}$$

Solving for d_2:

$$d_2 = \frac{300}{\tan(50°)}$$

Using $\tan(50°) \approx 1.1918$:

$$d_2 = \frac{300}{1.1918} \approx 251.5 \text{ m}$$

Step 3: Calculate the width of the river

Now that we have both distances, the width of the river is:

$$W = d_2 - d_1 = 251.5 - 109.2 = 142.3 \text{ m}$$

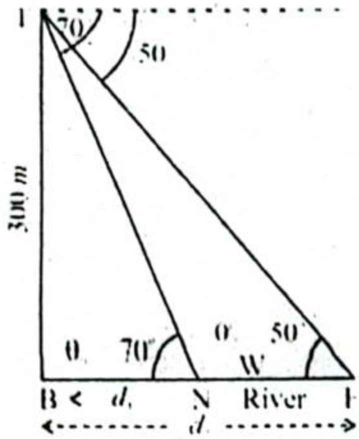
Step 4: Distance from the river to the foot of the hill

The distance from the foot of the hill to the river is just the value of d_2, which is **251.5 meters.**

Final Answers:

- The width of the river is approximately **142.3 meters.**
- The distance from the river to the foot of the hill is approximately **251.5 meters.**

Diagram:



Here is a simple diagram representing the situation:

In the diagram:

- The top of the hill is the starting point for both angles of depression.

The horizontal lines represent the distances from the foot of the hill to the points on the shore and across the river.

- d_1 is the distance to the nearer shore, d_2 is the distance to the point across the river, and the width of the river is the difference between these distances, $W = d_2 - d_1 = 251.5 - 109.2$
$= 142.3\ m$

10. A kite has 120m of string attached to it when at an elevation of 50°. How far is it above the hand holding it? (Assume that the string is tight.

To solve this problem, we can use trigonometry. Given that the string forms an angle of 50° with the horizontal ground, we can model the situation as a right triangle. The string represents the hypotenuse, and we need to find the vertical distance (height) from the hand to the kite.

Given:

- The length of the string (hypotenuse) = 120 m
- The angle of elevation = 50°

We need to find the vertical height of the kite, which is the opposite side of the right triangle formed by the string and the ground.

Step 1: Use the sine function

The sine of an angle in a right triangle is defined as the ratio of the opposite side to the hypotenuse. Thus:

$$\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$$

In our case: $\sin(50^\circ) = \frac{h}{120}$

where h is the height of the kite above the hand.

Step 2: Solve for h

We can rearrange the equation to solve for h:

$$h = 120 \times \sin(50^\circ)$$

Using $\sin(50^\circ) \approx 0.766$: $h = 120 \times 0.766 \approx 91.92\ \text{m}$

Final Answer:

The kite is approximately **91.92 meters** above the hand holding it.

Diagram:

Here is a simple diagram to represent the situation:

- The string forms a 50° angle with the ground, and the height $h = 91.92$ m is the vertical distance from the hand to the kite.