Calculating the Length of a Side in Right Triangles

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PRE-CALCULUS 11
TRIGONOMETRY
CALCULATING THE LENGTH OF A SIDE IN RIGHT TRIANGLES

A. Definitions

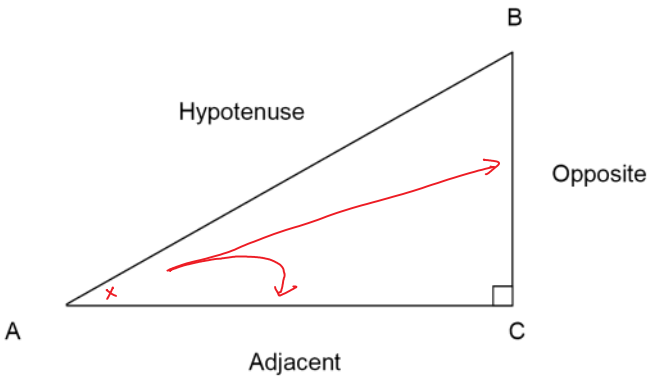
1. **Trigonometry:** the branch of mathematics concerned with the properties of the trigonometric functions (Sine, Cosine & Tangent) and their application to the determination of the angles and sides of triangles.

2. **Acute Angle:** an angle which measures less than 90 degrees.

3. **Theta:** a mathematical symbol, from the Greek alphabet, used to represent an angle. θ

B. Basic Trigonometry Functions

In Mathematics 10 we learn the 3 basic trig functions based on the sides in a right angle triangle. Remember that these trig ratios only work on right angle triangles!



$$SinA = \frac{Opposite}{Hypotenuse} \qquad CosA = \frac{Adjacent}{Hypotenuse} \qquad TanA = \frac{Opposite}{Adjacent}$$

To help remember the trig functions we use SOH CAH TOA .

Make sure to put your calculator in "Degree" Mode before doing any questions.

DEG or D
Triangle

~~RAD or R~~
~~Radian~~
~~Circle~~

~~Grad or G~~
~~Gradians~~
~~Surveying~~

C. Examples

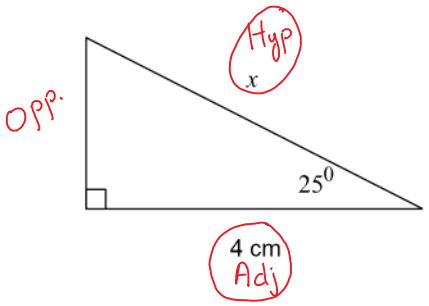
1. Find the following trig ratios. Round your answers to 4 decimals.

a) $Tan75^0$ — 3.7321

b) $Sin62^0$ — 0.8829

c) $Cos25^0$ — 0.9063

2. Calculate the value of x. Express your answer to the nearest tenth.



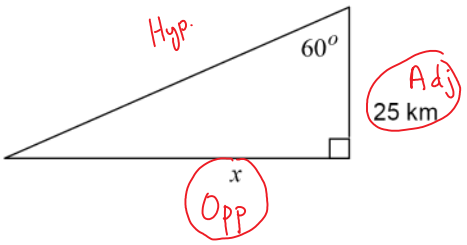
$\cos = \frac{Adj}{Hyp.}$

$\times \left[\cos 25^\circ = \frac{4}{x}\right]$

$\frac{\cos 25^\circ}{\cos 25^\circ} x = \frac{4}{\cos 25^\circ}$

$x = 4.4$ cm

3. Calculate the value of x. Express your answer to the nearest tenth.



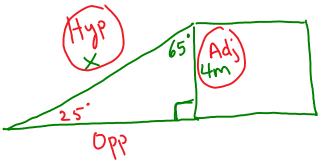
$\tan = \frac{Opp}{Adj}$

$25 \left[\tan 60^\circ = \frac{x}{25}\right]$

$(25)\tan 60^\circ = x$

$x = 43.3$ km

4. A ramp to the top of a box makes an angle of 65^o with the box. If the box is 4 m high, calculate the length of the ramp to the nearest tenth of a metre.



$\cos = \frac{Adj}{Hyp}$

$\times \left[\cos 65^\circ = \frac{4}{x}\right]$

$\frac{\cos 65^\circ}{\cos 65^\circ} x = \frac{4}{\cos 65^\circ}$

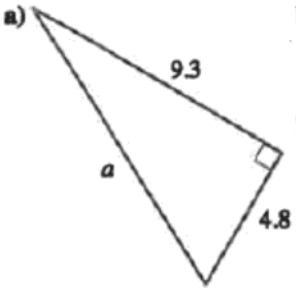
$x = 9.5$ m

Assignment: Calculating the Length of a Side in Right Triangles Assignment #1 – 6

Assignment

1. Calculate, to the nearest tenth, the length of the indicated side in each triangle.

a)



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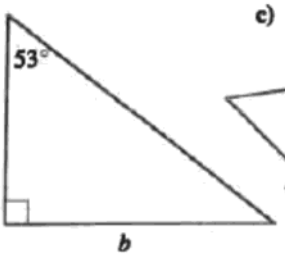

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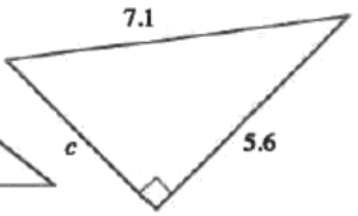

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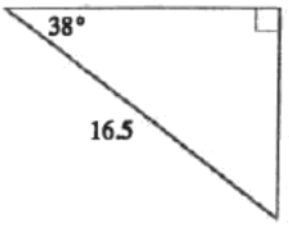

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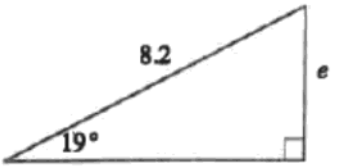

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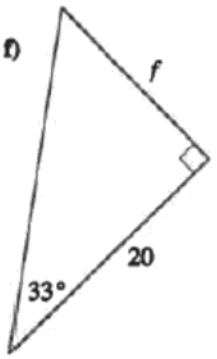

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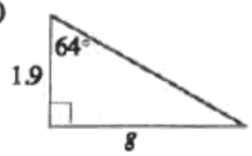

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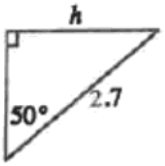
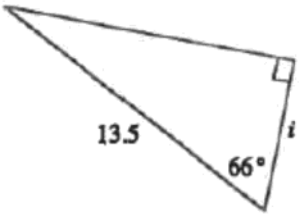
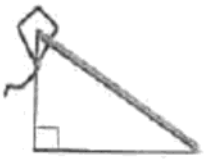


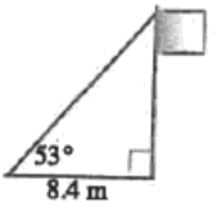
i)



2. A kite string is 65 metres long and makes an angle of 32° with the ground. Calculate, to the nearest metre, the vertical height, h, of the middle of the kite above the ground.



3. Use the measurements in the diagram to determine the height of the flagpole to the nearest tenth of a metre.



4. A ladder 5.3 m long is inclined at an angle of 72° to the ground.

a) How far up the wall, to the nearest tenth of a metre, does the ladder reach?

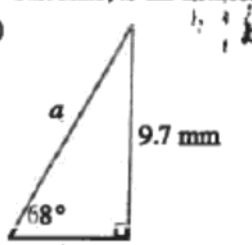
b) Use trigonometry to determine, to the nearest tenth of a metre, the distance between the bottom of the ladder and the bottom of the wall.

c) Use the answer to a) and the Pythagorean Theorem to determine, to the nearest tenth of a metre, the distance between the bottom of the ladder and the bottom of the wall.

d) Explain why the answers to b) and c) are different.

5. Calculate, to the nearest tenth, the length of the indicated side in each triangle.

a)



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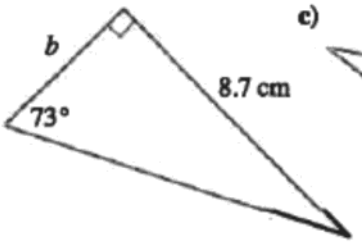

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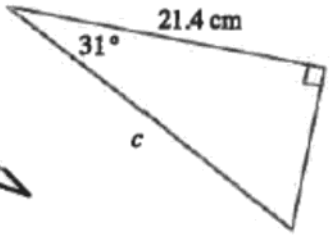

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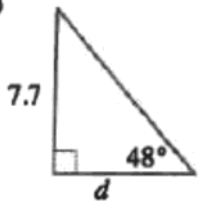

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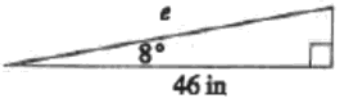
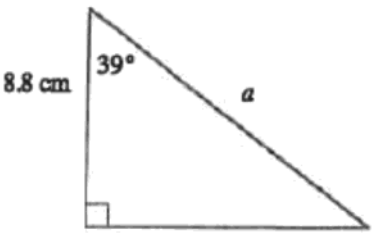


f)

6. Calculate, to the nearest tenth of a cm, the length of the indicated side in each triangle.

a)



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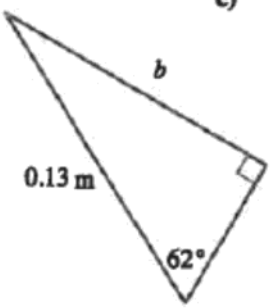

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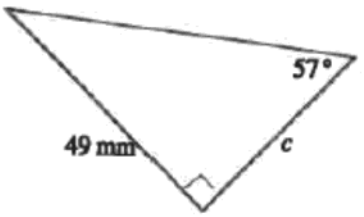
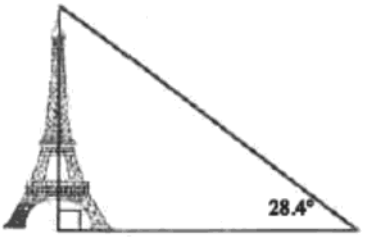


Numerical Response

11. On a particular day, the Eiffel Tower in Paris casts a shadow of 599 m. Use the sketch to determine the height of the tower. To the nearest metre, the height of the tower is



(Record your answer in the numerical response box from left to right)

12. In right triangle ABC, angle $ABC = 90°$, angle $BAC = 70°$, and $AC = 29$ units.

To the nearest whole number, the perimeter of the triangle is _____ units.

(Record your answer in the numerical response box from left to right)

Answer Key

1. a) 10.5 b) 12.7 c) 4.4 d) 13.0 e) 2.7 f) 13.0 g) 3.9 h) 2.1 i) 5.5

2. 34 m **3.** 11.1 m **4.** a) 5.0 m b) 1.6 m c) 1.8 m
d) Using a rounded length leads to a less accurate answer.

5. a) 10.5 mm b) 2.7 cm c) 25.0 cm d) 6.9 e) 46.5 in` f) 21.3 ft

6. a) 11.3 cm b) 11.5 cm c) 3.2 cm

7. a) There is no side length given. b) The triangle is not right angled.
c) We need the measure of one of the acute angles.

8. a) 46.6 mm b) 9.6 cm **9.** $LN = 7.8$, $MN = 10.0$ **10.** D

11. | 3 | 2 | 4 | |

12. | 6 | 6 | | |