Solving Equations

We need to **isolate the variable** by performing the **opposite operation** to both sides.

Ex. Solve.

$2x - 4 = 8$

$-3x + 5 = -10$

$5 - x = 7$

$-2 + 4x = -22$

$\frac{x}{4} - 5 = -7$

$3(r - 2) = 3$

$-20 = -5(3 + p)$

$\frac{-x}{12} - 6 = 4$

Why Did Gonzo Walk Around Carrying Ice Cream and a Pair of Sparrows?

Solve each equation below. Find your solution in the adjacent answer column and notice the two letters next to it. Print these letters in the two boxes at the bottom of the page that contain the number of that exercise.

① $\dfrac{1}{3}x + 5 = 9$

② $\dfrac{1}{8}a - 6 = 1$

③ $\dfrac{x}{4} + 7 = -2$

④ $5y - 4 = 7$

⑤ $9 - 4m = 19$

⑥ $\dfrac{x}{7} - 8 = -10$

⑦ $1 - \dfrac{n}{5} = 12$

⑧ $6t + 3 = -7$

⑨ $15 = -15 - 8u$

⑩ $0 = \dfrac{1}{6}y + 8$

⑪ $11 - \dfrac{1}{10}x = 10$

⑫ $50 = 8 + \dfrac{a}{2}$

⑬ $-10b - 7 = 9$

⑭ $18 = -\dfrac{w}{32} + 20$
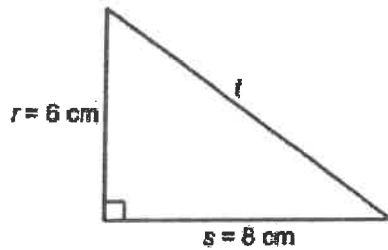
⑮ $\dfrac{x}{99} + 99 = 99$

⑯ $-10 = 9k - 40$

1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16

OBJECTIVE 4–i: To solve equations of the form $ax + b = c$, where a is an integer or unit fraction.
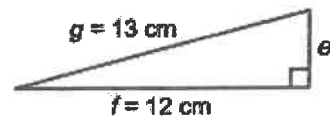
Pythagoras

Formula for Pythagoras:

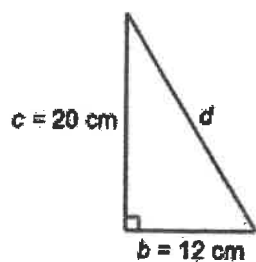1. Determine the length of the hypotenuse of this right triangle.
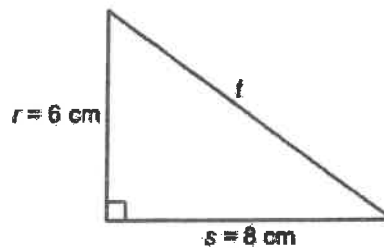
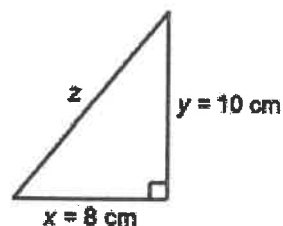2. Determine the length of the leg of this right triangle.

Solve:

1. What is the length of the hypotenuse of each right triangle? Show your work. Give your answer to the nearest tenth of a centimetre.

a)

$c = 20$ cm $\quad d$
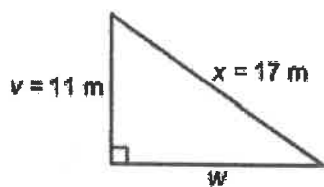
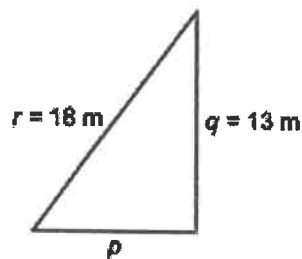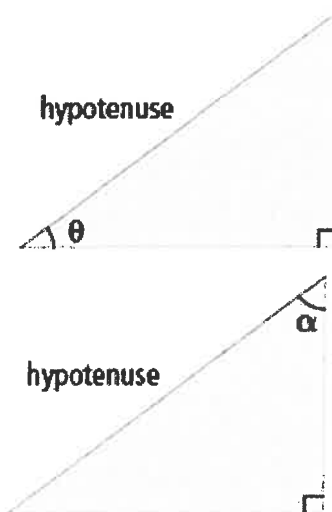$b = 12$ cm

b)

z $\quad y = 10$ cm

$x = 8$ cm

2. Use the Pythagorean relationship to determine the unknown leg length of each right triangle. Give your answer to the nearest metre. Show your work.
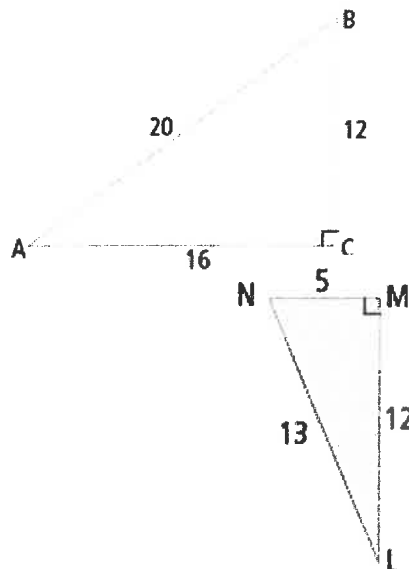
a)

$v = 11$ m $\quad x = 17$ m

w

b)

$r = 18$ m $\quad q = 13$ m

p

Name: _____

Unit 1: Right Angle Trigonometry

1.2 The Tangent Ratio

Right Triangle:

Hypotenuse:

Opposite Side:

Adjacent Side:

A trigonometric ratio is a ratio of the measures of two sides of a right triangle.

Tangent Ratio:

Ex. Write a Tangent Ratio
Write each trigonometric ratio.
a) tan A   **b)** tan B

Calculate each trigonometric ratio.
a) tan L   **b)** tan N

Ex. Calculate a Tangent and an Angle

a) Calculate tan 25° to four decimal places.

tan 25° =

b) Draw a triangle to represent $\tan \theta = \frac{5}{4}$. Calculate the angle θ to the nearest tenth of a degree.

Use your particular calculator to calculate each tangent ratio (to four decimal places) and angle (to the nearest degree).

θ	Tan θ
27°	
45°	
57°	

| θ	Tan θ
	0.5095
	0.5543
	1.4653

Ex. Determine a Distance Using the Tangent Ratio

A surveyor wants to determine the width of a river for a proposed bridge. The distance from the surveyor to the proposed bridge site is 400 m. The surveyor uses a theodolite to measure angles. The surveyor measures a 31° angle to the bridge site across the river. What is the width of the river, to the nearest metre?
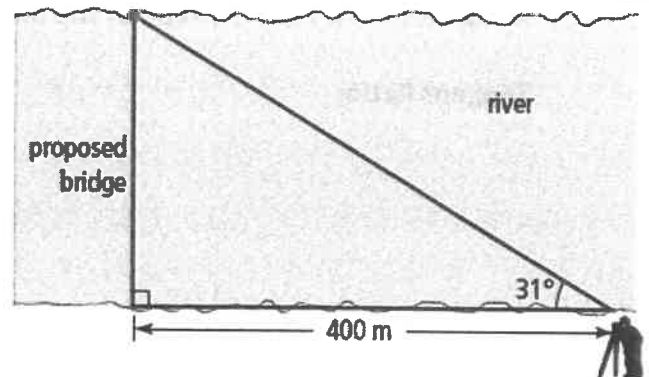
A ladder leaning against a wall forms an angle of 63° with the ground. How far is the foot of the ladder from the wall (to the nearest tenth) if the ladder reaches 5 m up the wall?

5 m

63°
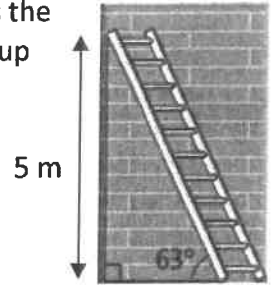
Ex. Determine an Angle Using the Tangent Ratio
A small boat is 95 m from the base of a lighthouse that has a height of 36 m above sea level. Calculate the angle from the boat to the top of the lighthouse. Express your answer to the nearest degree.

θ

36 m

95 m
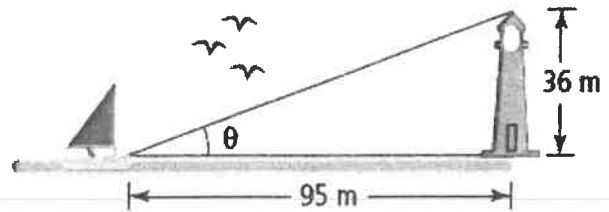
A radio transmission tower is to be supported by a guy wire. The wire reaches 30 m up the tower and is attached to the ground a horizontal distance of 14 m from the base of the tower. What angle does the guy wire form with the ground, to the nearest tenth of a degree?

1.3 Sine & Cosine Ratios
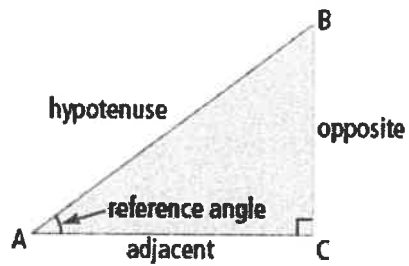
$$\sin A = \frac{\text{length of side opposite } \angle A}{\text{length of hypotenuse}}$$

$$\cos A = \frac{\text{length of side adjacent to } \angle A}{\text{length of hypotenuse}}$$

Ex. Write Trigonometric Ratios
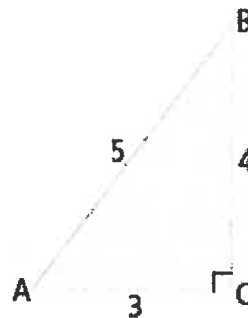Write each trigonometric ratio.

a) sin A

b) cos A

c) tan A

d) sin B

e) cos B

f) tan B

Ex.

    a) Evaluate each ratio, to four decimal places.

    $\sin 42° =$ $\cos 68° =$

    b) Determine each angle measure, to the nearest degree.

    $\sin \theta = 0.4771$ $\cos \beta = 0.7225$

What does the 0.4771 represent?

Ex. In the World Cup Downhill held at Panorama Mountain Village in British Columbia, the skiers raced 3514 m down the mountain. If the vertical height of the course was 984 m, determine the average angle of the ski course with the ground. Express your answer to the nearest tenth of a degree.

Ex. A pilot starts his takeoff and climbs steadily at an angle of 12.2°. Determine the horizontal distance the plane has travelled when it has climbed 5.4 km along its flight path. Express your answer to the nearest tenth of a kilometre.

Ex. Determine the height of a kite above the ground if the kite string extends 480 m from the ground and makes an angle of 62° with the ground. Express your answer to the nearest tenth of a metre.

1.4/1.5 Problems & Solving Triangles

Angle of Elevation:

Angle of Depression:
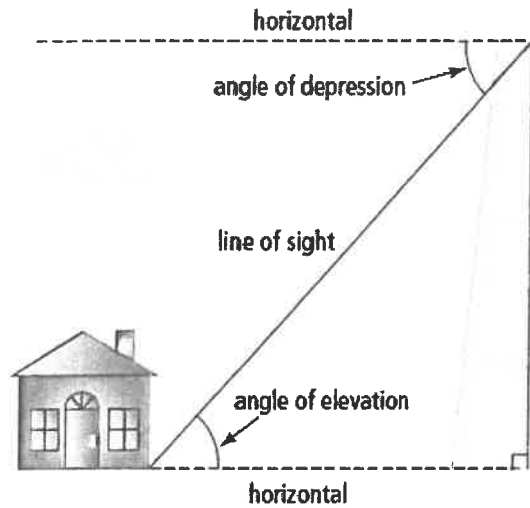
Ex. Sean wants to calculate the height of the First Nations Native Totem Pole. He positions his transit 19.0 m to the side of the totem pole and records an angle of elevation of 63° to the top of the totem pole. If the height of Sean's transit is 1.7 m, what is the height of the totem pole, to the nearest tenth of a metre?

Ex. A balloonist decides to use an empty football field for his landing area. When the balloon is directly over the goal post, he measures the angle of depression to the base of the other goal post to be 53.8°. Given that the distance between goal posts in a Canadian football field is 110 yd, determine the height of the balloon.
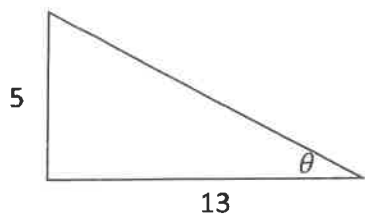
Solve a Triangle:

Ex. Solve the triangle shown. Express each measurement to the nearest whole unit.

A

22 cm

42°

C   B
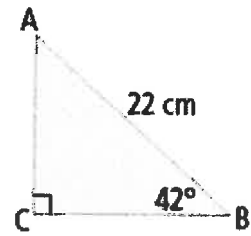
Ex. Solve $\triangle DEF$ if $\angle E = 90°$, $d = 42\ m$, and $f = 31\ m$. Express sides to the nearest tenth & angles to the nearest degree.
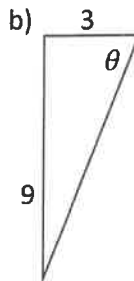
1. State the value of **tan θ** in each right triangle:

    a)   b)   3

    tan θ = _____   tan θ = _____

2. Use your calculator to determine each tan ratio to 4 decimal places:

    a) tan 25° = _____   b) tan 72.8° = _____

3. Use your calculator to determine the value θ to the nearest tenth:

    a) tan θ = 0.3157   b) tan θ = $\frac{5}{2}$

    θ = _____ θ = _____

4. Determine the designated side length or angle to the nearest tenth:

                            x

    a)   6.8 m

b)

5 cm

θ

22.5 cm

c)

72°

15 in.   x
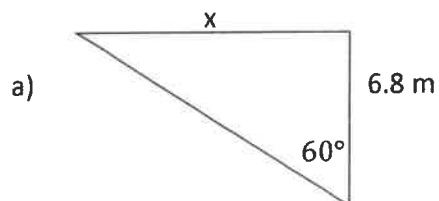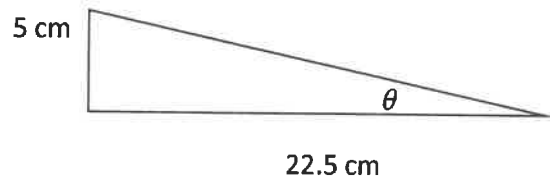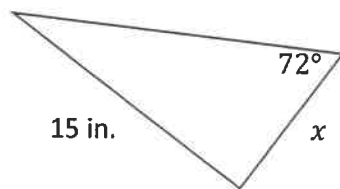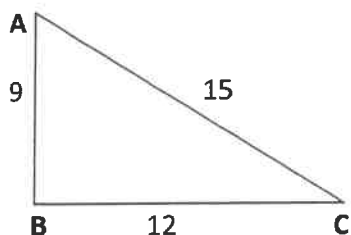
Quiz tomorrow will include a word problem.

Name: _____

Formal Assignment

1. State each ratio, in lowest terms, for the triangle below. (1 mark each)

a) sin A = _____

b) cos A = _____

c) tan C = _____

2. State each value to 4 decimal places. (1 mark each)

a) sin 65° = _____

b) cos 33° = _____

c) tan 6° = _____

3. For each given trig ratio, state the angle to 1 decimal place. (1 mark each)

a) cos A = 0.7832

b) tan B = 2.362

c) sin C = $\dfrac{5}{7}$

∠A = _____

∠B = _____

∠C = _____

4. Find indicated unknown to 1 decimal place. Show work. (2 marks each)

a)

x   120 m

41⁰

y

x = _____

y = _____

b)

θ

28 m

35 m

θ = _____

c)

8 cm

5 cm

θ

θ = _____
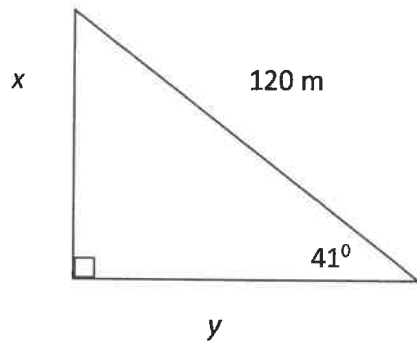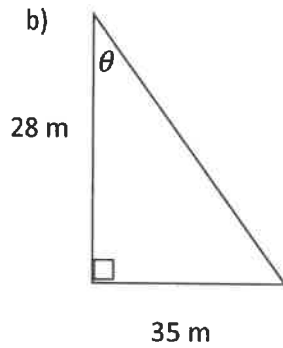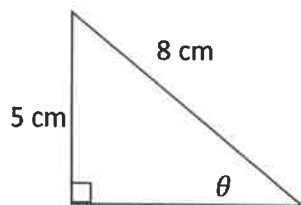
5. Solve each triangle. Show work (including a diagram). Side lengths to 1 decimal place, angles to the nearest degree. (4 marks each)

a) $\triangle ABC, \angle B = 90°, \angle A = 35°, AB = 5cm$

$\angle C =$ _____

$AC =$ _____

$BC =$ _____

b) $\triangle PQR, \angle Q = 90°, q = 12m, r = 7m$

$\angle P =$ _____

$\angle R =$ _____

$p =$ _____

6. Solve each problem. Include a diagram and show all work. Answers to the nearest tenth.

a) On a sunny day, the angle of elevation of the sun is 53^0. A tree, 18 m in height, casts a shadow. How long is the shadow? (3 marks)

_____

b) A wire 69.8 m in length is attached to the top of a tower. The wire makes an angle of 63^0 with the ground. How high is the tower? (3 marks)

_____

c) A ladder that is 8.5 m long leans against the wall. The ladder just reaches a window that is 7.8 m above the ground. What is the measure of the angle that the ladder makes with the wall? (3 marks)
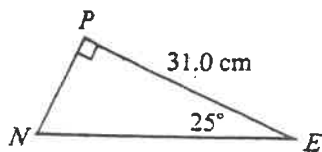
_____

Solving Triangles WS

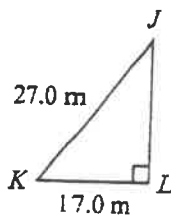Show diagram and <u>all</u> work on separate sheet.
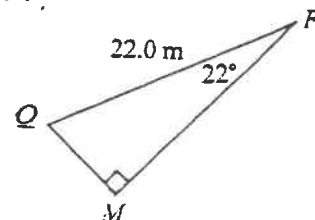Round side lengths to one decimal, and angles to nearest whole number.
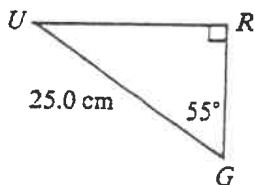
Solve each triangle:

1.

P   31.0 cm
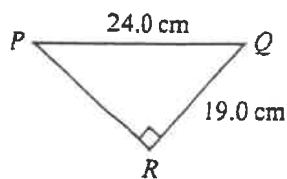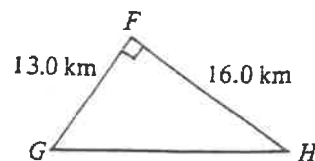
N   25°   E

5.

J

27.0 m

K   17.0 m   L

9.

22.0 m   F
22°
Q

M

2.

U   R

25.0 cm   55°

G

6.

24.0 cm
P   Q

19.0 cm

R

10.

F

13.0 km   16.0 km

G   H

3.

A

8.0 mm

B   5.0 mm   C

7.

T

65°

A   32.0 m   L

11.

29.0 m
U   T

39.0 m

V

4.

D

S   35°   W
18.0 m

8.

B   50°   C

7.0 cm

R

12.

6.0 cm
D   E

12.0 cm

F
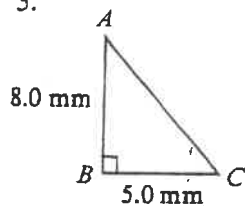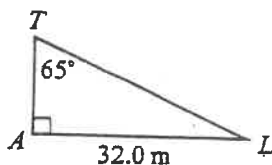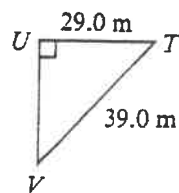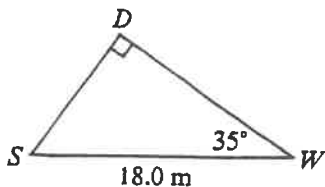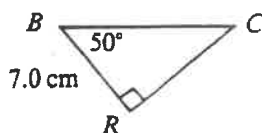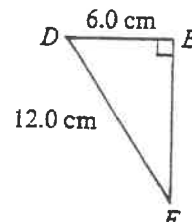
Solve △ABC, given ∠B = 90° and the following measures:

13. AB = 5.0cm, BC = 3.0cm

14. ∠A = 27°, AC = 10m

15. c = 15cm, ∠A = 35°

16. b = 15.4cm, c = 7.8cm

17. BC = 4.1m, AC = 7.9m

18. ∠C = 50°, b = 20cm

19. ∠C = 62°, BC = 100mm

20. a = 4.1m, c = 7.9m

KEY

$NP = 14.5cm$
1. $EN = 34.2cm$
$\angle N = 65°$

$RU = 20.5cm$
2. $GR = 14.3cm$
$\angle U = 35°$

$\angle A = 32°$
3. $\angle C = 58°$
$AC = 9.4mm$

$DS = 10.3m$
4. $DW = 14.7m$
$\angle S = 55°$

$\angle A = 31°$
13. $\angle C = 59°$
$AC = 5.8cm$

$AB = 8.9m$
14. $BC = 4.5m$
$\angle C = 63°$

$a = 10.5cm$
15. $b = 18.3cm$
$\angle C = 55°$

$\angle A = 60^0$
16. $\angle C = 30°$
$a = 13.3cm$

$\angle J = 39°$
5. $\angle K = 51°$
$JL = 21.0m$

$\angle P = 52°$
6. $\angle = 38°$
$PR = 14.7cm$

$AT = 14.9m$
7. $LT = 35.3m$
$\angle L = 25°$

$CR = 8.3cm$
8. $BC = 10.9cm$
$\angle C = 40°$

$\angle A = 31°$
17. $\angle C = 59°$
$AB = 6.8m$

$a = 12.9cm$
18. $c = 15.3cm$
$\angle A = 40°$

$AB = 188.1mm$
19. $AC = 213.0mm$
$\angle A = 28°$

$\angle A = 27°$
20. $\angle C = 63°$
$b = 8.9m$

$MQ = 8.2m$
9. $FM = 20.4m$
$\angle Q = 68°$

$\angle G = 51°$
10. $\angle H = 39°$
$GH = 20.6km$

$\angle T = 42°$
11. $\angle V = 48°$
$UV = 26.1m$

$\angle D = 60°$
12. $\angle F = 30°$
$EF = 10.4cm$

Applications :

Draw a diagram and show work. Answers to one decimal place.

1. From a point on the ground 500 m from the base of a building, the angle of elevation of the top of the building is 12°. How tall is the building?

2. From the top of a building 34 m high the angle, the angle of depression of a bus parked on the street is 53°. How far is the bus from the building?

3. A boat is 350 m from the base of a cliff. If the cliff is 180 m high, find the angle of elevation of the top of the cliff from the boat.

4. From a point 132 m above the ground in a control tower, the angle of depression of an airplane is 38°. How far is the airplane from the base of the tower?

5. A rope tied to the top of a statue is anchored to the ground 18 m from the base of the statue, creating an angle of elevation of 27^0. How long is the rope?

6. At a concert, Tony is sitting 40 m away from the stage. He is 10 m above the level of the stage. At what angle of declination is he watching the concert?

7. A steel cable is attached to the top of a television mast. The cable is also attached to the ground at a point 9.8 m from the base of the mast and makes an angle of elevation of 65°.
   a) How tall is the mast?
   b) How long is the cable?

8. A tightrope walker plans to walk along a cable attached to the top of two adjacent buildings (from the shorter to the taller). The cable is 21.5 m long and the angle of inclination of the taller building from the smaller is 12°.
   a) How far apart are the buildings?
   b) What is the difference in the heights of the buildings?

9. Two office buildings are 31.7 m apart. From the top of the shorter, the angle of elevation to the top of the other is 27.5°, while the angle of depression to the base is 78.2°. Find the height of each building.

KEY

1. 106.3 m

2. 25.6 m

3. 27.2°

4. 169.0 m

5. 20.2 m

6. 14.0 m

7. a) 21.0 m
   b) 23.2 m

8. a) 21.0 m
   b) 4.5 m

9. 168.2 m