Important Concepts . . .

Preview Review

Mathematics Grade 8 TEACHER KEY

W3 - Lesson 1: Pythagorean Theorem

Important Concepts of Grade 8 Mathematics

W1 - Lesson 1 ..... Perfect Squares and Square Roots
W1 - Lesson 2 ..... Working with Ratios and Rates
W1 - Lesson 3 ..... Multiplying and Dividing Fractions
W1 - Lesson 4 ..... Multiplying and Dividing Integers
W1 - Lesson 5 ..... Working with Percents
W1 - Review
W1 - Quiz

W2 - Lesson 1 ..... Modelling and Solving Linear Equations Using Algebra Tiles
W2 - Lesson 2 ..... Solving Linear Equations
W2 - Lesson 3 ..... Graphing and Analyzing Linear Relations
W2 - Lesson 4 ..... Critiquing the Representation of Data
W2 - Lesson 5 ..... Probability of Independent Events
W2 - Review
W2 - Quiz

W3 - Lesson 1 ..... Pythagorean Theorem
W3 - Lesson 2 ..... Calculating Surface Area
W3 - Lesson 3 ..... Calculating Volume
W3 - Lesson 4 ..... Drawing 3-D Objects
W3 - Lesson 5 ..... Congruence of Polygons
W3 - Review
W3 - Quiz

Materials Required

Protractor
Ruler
Calculator

No Textbook Required

This is a stand-alone course.

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Preview/Review Concepts for Grade Eight Mathematics

Teacher Key

W3 – Lesson 1:

Pythagorean Theorem

OBJECTIVES

By the end of this lesson, you will be able to:

- Model and explain the Pythagorean Theorem pictorially.
- Determine whether or not a given triangle is a right triangle by applying the Pythagorean Theorem.
- Determine the measure of the third side of a right triangle, given the measures of the other two sides, to solve a given problem.

GLOSSARY

Hypotenuse – the side of a right triangle that is opposite that right angle; it is the longest side of a right triangle.

Pythagorean Theorem – in a right triangle, the area of the square drawn on the hypotenuse is equal to the sum of the areas of the squares drawn on the other two sides.

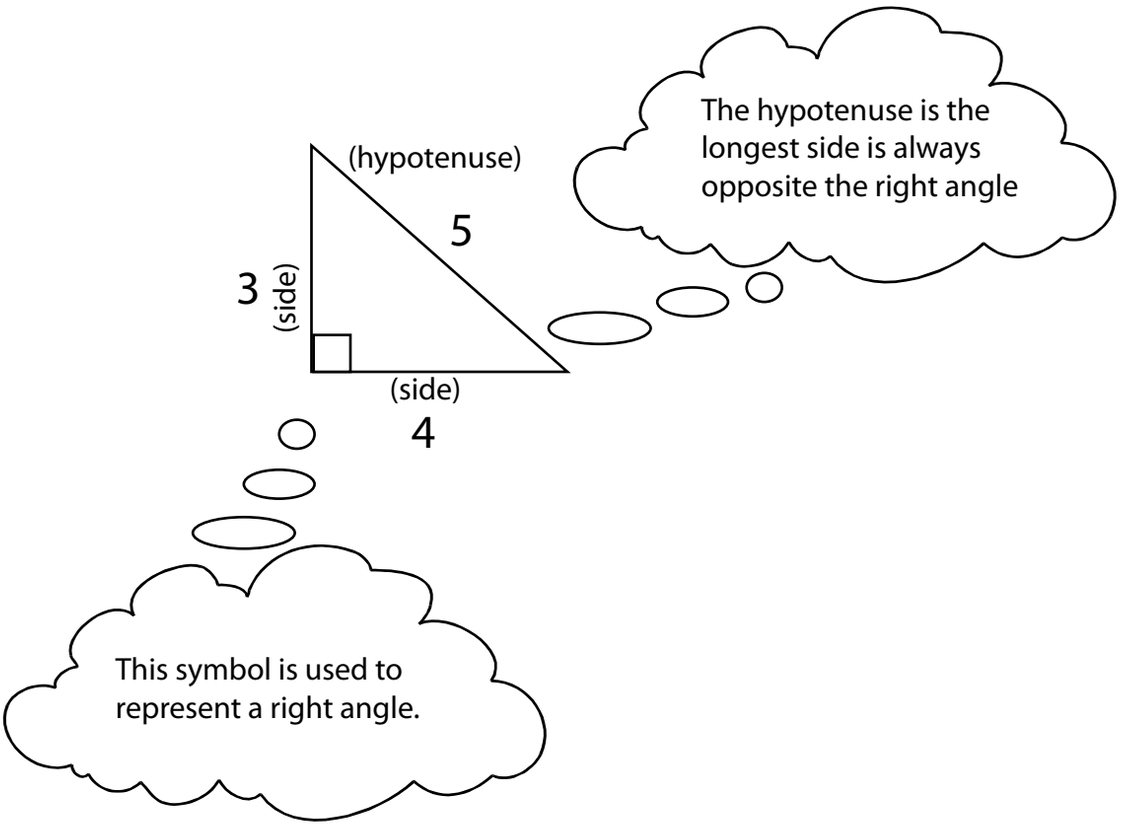
W3 – Lesson 1: Pythagorean Theorem

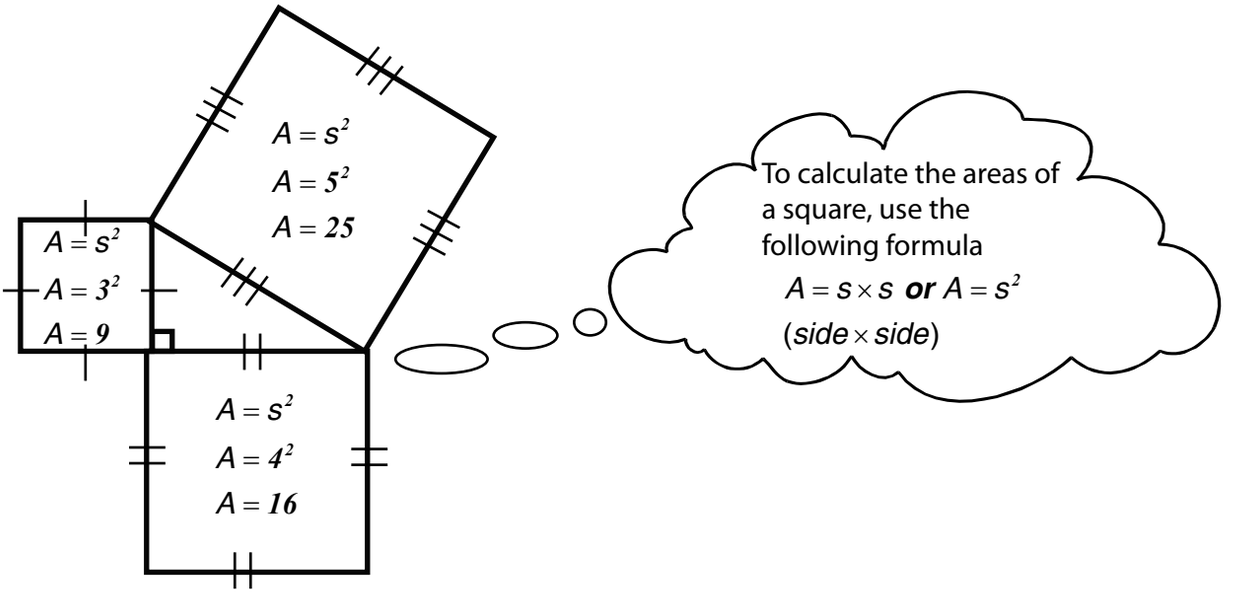
Materials required:

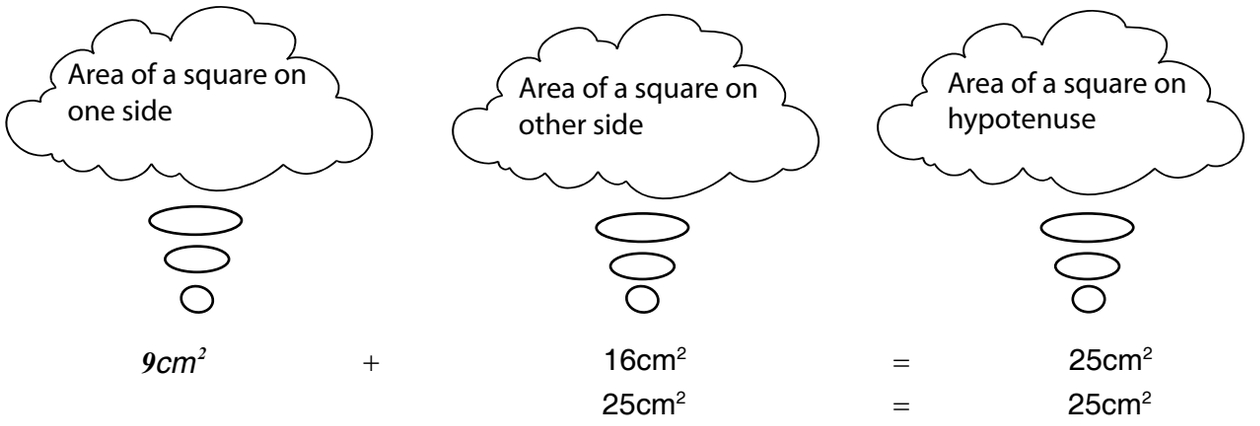
- Paper, Pencil, Calculator

The Pythagorean Theorem

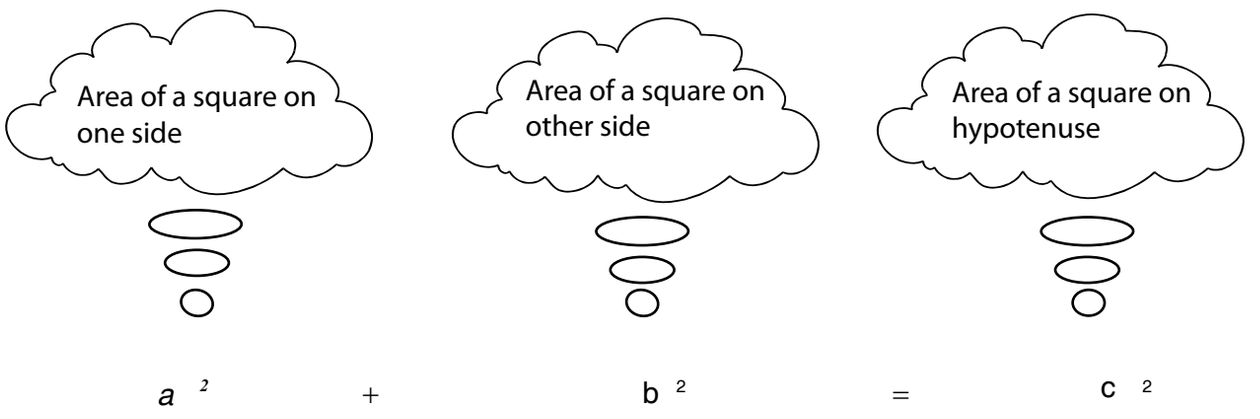
The Pythagorean Theorem is used when working with right angle triangles. The following example illustrates how the Pythagorean Theorem compares the areas of squares drawn on the sides of a right triangle. The area of the square drawn on the hypotenuse is equal to the sum of the areas of squares drawn on the other two sides. Study the following example.







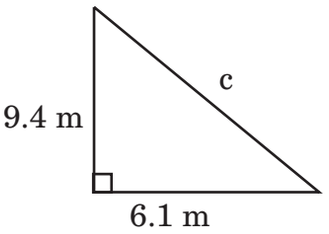
In any right angle triangle, the Pythagorean Theorem holds true. It can be summarized as follows:



If you know the lengths of two of the three sides of the triangle, you can solve for the unknown side.
If the Pythagorean Theorem does not work on a triangle, then that triangle is not a right triangle.

Example 1

Find the length of unknown side using the Pythagorean Theorem. (Drawing is not to scale).



Apply the formula and substitute the value for the known sides.

$a^2 + b^2 = c^2$
$(6.1)^2 + (9.4)^2 = c^2$

Evaluate the exponents and add the value of a^2 to the value of b^2.

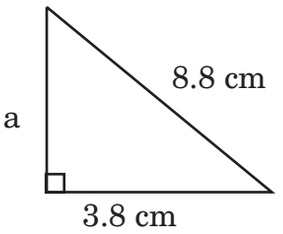
$(6.1)^2 + (9.4)^2 = c^2$
$37.21 + 88.36 = c^2$
$125.57 = c^2$

To determine the value of c, you must take the square root of both sides.
$125.57 = c^2$
$\sqrt{125.57} = \sqrt{c^2}$
$11.2 \approx c$

The length of the unknown side is 11.2 m.

Example 2

Find the length of unknown side using the Pythagorean Theorem. (Drawing is not to scale).



Apply the formula and substitute the value for the known sides.

$a^2 + b^2 = c^2$
$(3.8)^2 + b^2 = (8.8)^2$

Evaluate the exponents.

$(3.8)^2 + b^2 = (8.8)^2$
$14.44 + b^2 = 77.44$

Isolate b^2 by applying inverse operations to both sides of the equation.

$14.44 - 14.44 + b^2 = 77.44 - 14.44$
$b^2 = 63$

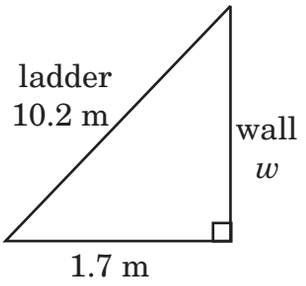
To determine the value of b, you must take the square root of both sides.
b2 = 63
$\sqrt{b^2} = \sqrt{63}$
$b \approx 7.9$

The length of the unknown side is 7.9 cm.

Example 3

A ladder is 10.2 m long. The bottom of the ladder is 1.7 m away from the base of the wall. How high on the wall will the ladder reach?

Draw a diagram that represents the situation.



Apply the Pythagorean Theorem. In a problem solving situation, you can use different letters to represent the sides of the right triangle formed.

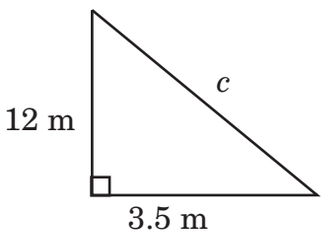
$$\begin{aligned} a^2 + b^2 &= c^2 \\ (1.7)^2 + H^2 &= (10.2)^2 \\ 2.89 + H^2 &= 104.04 \\ 2.89 - 2.89 + H^2 &= 104.04 - 2.89 \\ H^2 &= 101.15 \\ \sqrt{H^2} &= \sqrt{101.15} \\ H &\approx 10.1 \end{aligned}$$

The ladder will reach approximately 10.1 m up the wall.

Practice Questions

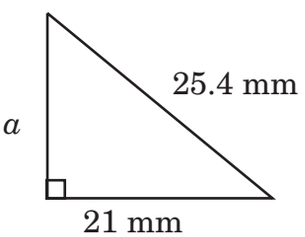
Calculate the length of the unknown sides of the following right triangles. Round the result to the nearest tenth if necessary.

1.



$$\begin{aligned} a^2 + b^2 &= c^2 \\ (12)^2 + (3.5)^2 &= c^2 \\ 144 + 12.25 &= c^2 \\ 156.25 &= c^2 \\ \sqrt{156.25} &= \sqrt{c^2} \\ 12.5 &\approx c \end{aligned}$$

2.

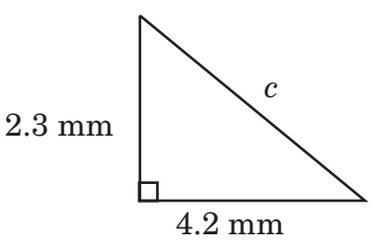


$$\begin{aligned} a^2 + b^2 &= c^2 \\ (21)^2 + b^2 &= (25.4)^2 \\ 441 + b^2 &= 645.16 \\ 441 - 441 + b^2 &= 645.16 - 441 \\ b^2 &= 204.16 \\ \sqrt{b^2} &= \sqrt{204.16} \\ b &\approx 14.3 \end{aligned}$$

Lesson 1: Assignment

Find the length of the unknown side. Round your answer to the nearest tenth.

1.



$$\cdot\ \cdot + = $$

$$(2.3)^2 + (4.2)^2 = c^2$$

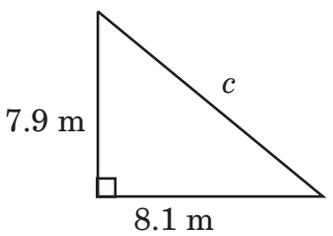
$$5.29 + 17.64 = c^2$$

$$22.93 = c^2$$

$$\sqrt{22.93} = \sqrt{c^2}$$

$$4.8 \approx c$$

2.



$$a^{\cdot} + b = c$$

$$(8.1)^{\cdot} + (7.9) = c$$

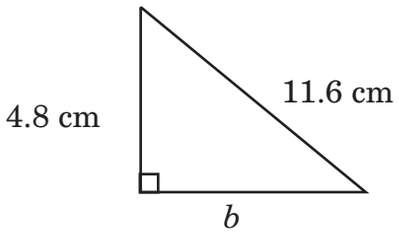
$$65.61 + 62.41 = c^2$$

$$128.02 = c^2$$

$$\sqrt{128.02} = \sqrt{c^2}$$

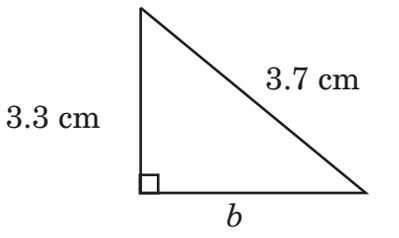
$$11.3 \approx c$$

3.



$$a^{ü} + b = c$$
$$(4.8)^{ü} + b = (11.6)$$
$$23.04 + b^2 = 134.56$$
$$23.04 - 23.04 + b^2 = 134.56 - 23.04$$
$$b^2 = 111.52$$
$$\sqrt{b^2} = \sqrt{111.52}$$
$$b \approx 10.6$$

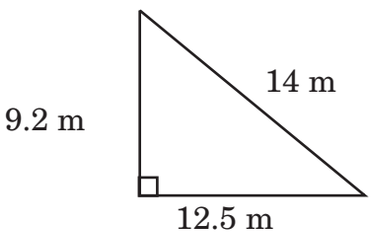
4.



$$a^{ü} + b = c$$
$$(3.3)^{ü} + b = (3.7)$$
$$10.89 + b^2 = 13.69$$
$$10.89 - 10.89 + b^2 = 13.69 - 10.89$$
$$b^2 = 2.8$$
$$\sqrt{b^2} = \sqrt{2.8}$$
$$b \approx 1.7$$

Determine if the following triangles are right triangles by applying the Pythagorean Theorem.

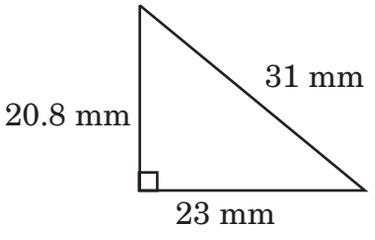
5.



$$a^{ii} + b = c$$
$$(12.5)^{ii} + (9.2) = c$$
$$156.25 + 84.64 = c^2$$
$$240.89 = c^2$$
$$\sqrt{240.89} = \sqrt{c^2}$$
$$15.5 \approx c$$

Since the measure of side c is 14 m this is not a right triangle.

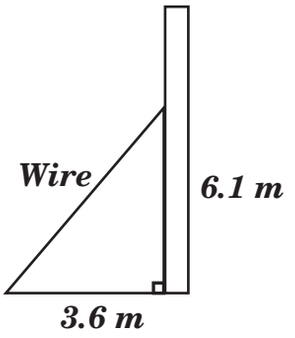
6.



$$a^{ii} + b = c$$
$$a^{ii} + (23) = (31)$$
$$a^2 + 529 = 961$$
$$a^2 + 529 - 529 = 961 - 529$$
$$a^2 = 432$$
$$\sqrt{a^2} = \sqrt{432}$$
$$a \approx 20.8$$

Since the measure of side a is 20.8 mm this is not a right triangle.

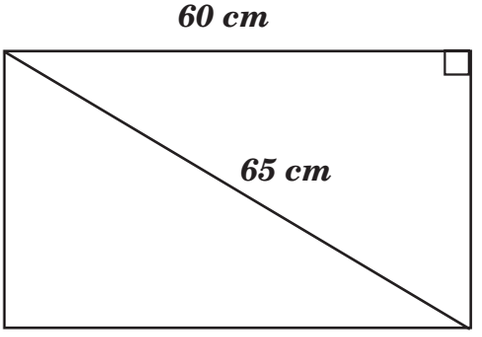
7. A power pole is supported by a guy wire. The wire is anchored in the ground 3.6 metres away from the base of the pole and is attached 6.1 metres high on the pole. How long is the wire, rounded to the nearest tenth of a metre?



$$a^{ü} + b = c$$
$$(3.6)^{ü} + (6.1) = w$$
$$12.96 + 37.21 = w^2$$
$$50.17 = w^2$$
$$\sqrt{50.17} = \sqrt{w^2}$$
$$7.1 \approx w$$

The wire is 7.1 metres long.

8. A rectangle is 60 cm in length. Its diagonal is 65 cm long. What is the width of the rectangle?



The width of the rectangle is 25 cm.

$$a^{ü} + b = c$$
$$w^{ü} + (60) = (65)$$
$$w^2 + 3600 = 4225$$
$$w^2 + 3600 - 3600 = 4225 - 3600$$
$$w^2 = 625$$
$$\sqrt{w^2} = \sqrt{625}$$
$$w \approx 25$$


LEARNING
ANYTIME ANYWHERE