# Unit 4 - Using Equations to Solve Word Problems

| Solving Problems using Equations<br>Section 7.8<br>Pages 364-367 | Word Problem Format: 1) Givens: 2) Find: 3) Let....<br>4) Solution 5) Conclusion<br>Using diagrams(length&width) and charts(value)<br>Working backwards<br>Pythagorean Theorem: $a^2 + b^2 = c^2$<br>Classwork: Pg 366 -1, 4, 8, 11, 13, 17, 19, 20, 23, 28, 29, 31, 34, 37, 38<br>Homework: Pg 366 - 2, 3, 5, 6, 7, 9, 10, 12, 14, 18, 21, 22, 24, 25, 26, 27, 30, 32, 33, 35, 36, 39 |
|---|---|
| **Pythagorean Theorem**<br>P453 | Classwork: Pg 366 - 15, Pg 453 - 1, 2, 6, 7<br>Homework: Pg 366 -16, Pg 453 - 3, 4, 5, 8 |

**Notes:** "Let statements are necessary": Let the variable the "base" unknown.

Answer the question which is asked.

Pythagorean Theorem

$$c^2 = a^2 + b^2$$

**Classwork: Page 366**

*Each statement has two unknowns. Represent both in terms of x.*
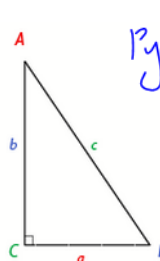
**1.** The sum of two numbers is 35.

Let $x$ be one number

Then the other is $35 - x$

**4.** The length and width of a rectangle total 36 cm.

Let $x$ be the length

Then the width is $36 - x$

**8.** The parking meter has 246 coins in quarters and dimes.

Let $x$ be the number of quarters
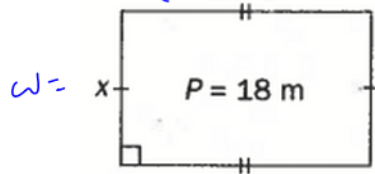
Then the number of dimes is $246 - x$

*Find the length of each side.*

**11.** $\ell = x + 3$

$w = x$   $P = 18$ m

$P = 2w + 2\ell$

$18 = 2(x) + 2(x+3)$

$2x + 2x + 6 = 18$

$4x = 18 - 6$

$4x = 12$

$x = 3$

∴ The width is 3m ∴ length is 6m.

**13.** $\ell = x + 1$

$w = 2$   $A = 12$ m²   $A = \ell \times w$

$(x+1)(2) = 12$

$2x + 2 = 12$

$2x = 10$

∴ $x = 5$

∴ The length is 6m.

**Applications and Problem Solving**

**17. Numbers** The sum of 2 numbers is 46. One number is 12 more than the other. What are the numbers?

Let $x$ be the smaller number
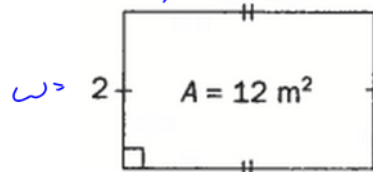Then the bigger number is $x + 12$

$x + (x+12) = 46$

$2x + 12 = 46$

$2x = 34$

$x = 17$

∴ The numbers are
17 and $17 + 12 = 29$

**19. Measurement** The length of a rectangle is 5 m more than its width. Its perimeter is 90 m. What are its dimensions?

Let $x$ be the width
Then the length is $x + 5$

$2(x + (x+5)) = 90$

$2(2x + 5) = 90$

$4x + 10 = 90$

$4x = 80$

$x = 20$

∴ The dimensions are

width = 20m and

length = 25m.

**20. Numbers** The sum of 3 consecutive whole numbers is 105. Find the numbers.

*one after the other* (annotation, "consecutive" circled)

Let the smallest number be $x$

Then the next one is $x+1$ and $x+2$ is the last

$$x + (x+1) + (x+2) = 105$$
$$3x + 3 = 105$$
$$3x = 102$$
$$x = 34$$

∴ The numbers are 34, 35, 36

**28. Coins** Aretha has $0.85 in nickels and dimes. She has 2 more nickels than dimes. How many nickels and dimes does she have?

*Not as easy* (annotation)

*We need to deal w/ value of money!* (annotation, "value" circled)

Let $x$ be dimes

Then $x+2$ is the number of nickels.

Value:
dimes : $0.1x$
nickels: $0.05(x+2)$

$$0.1x + 0.05(x+2) = 0.85$$
$$0.1x + 0.05x + 0.1 = 0.85$$
$$0.15x = 0.75$$
$$x = \frac{0.75}{0.15}$$
$$= 5$$

∴ Aretha has 5 dimes and 7 nickels.

**23. Women's hockey** When Canada won the Women's World Hockey Championships, the Canadian team scored 35 more goals than were scored against it. The total number of goals scored in the games that Canada played was 41.
**a)** How many goals were scored against Canada?
**b)** How many goals did Canada score?

Let $g$ be the goals scored against Canada

Then Canada scored $g+35$

$$g + (g+35) = 41$$
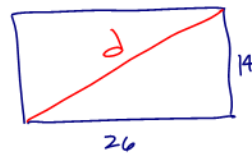$$2g + 35 = 41$$
$$2g = 6$$
$$g = 3$$

a) 3 goals

b) We scored 38 goals (35+3)

**29. Basketball court** A basketball court is a rectangle with dimensions 26 m by 14 m. What is the length of a diagonal, to the nearest metre?

Pythagorean Theorem

Picture



Let $d$ be the length of the diagonal.

$$d^2 = 26^2 + 14^2$$
$$d^2 = 676 + 196$$
$$d^2 = 872$$
$$∴ d = \sqrt{872}$$
$$= 29.5 \text{ m}.$$

∴ The diagonal is about 30m.

**31. Numbers** The sum of two numbers is 39. Twice the first number plus 3 times the second number is 101.
a) Find the numbers using guess and check.
b) Find the numbers by writing and solving an equation.
c) Which method do you prefer? Why?

Let $x$ be one number
Then the other number is $39-x$

$$2x + 3(39-x) = 101$$
$$2x + 117 - 3x = 101$$
$$-x = -16$$
$$\therefore x = 16$$

$\therefore$ The numbers are 16
and $39 - 16 = 23.$

**34. Pizza sales** Large pizzas cost $12.50 and small pizzas cost $9.00. The pizza parlour sold 38 pizzas with a total value of $415.50. How many of each type did the pizza parlour sell? Explain how you used a mathematical model to solve the problem.

Value of
small pizza
$9x$
(large : $12.50(38-x)$

Let $x$ be the number of small pizzas
Then they sold $38-x$ large pizzas

$$9x + 12.5(38-x) = 415.50$$
$$9x + 475 - 12.5x = 415.50$$
$$-3.5x = 415.50 - 475$$
$$-3.5x = -59.50$$
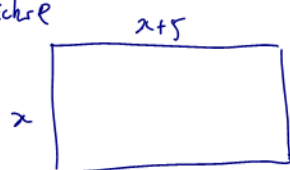$$x = \frac{-59.50}{-3.5} = 17$$

$\therefore$ They sold 17 small pizzas and 21 large pizzas

**37. Picture** A picture is 5 cm longer than it is wide. The perimeter of the picture is 90 cm.
a) What is the width of the picture?
b) The picture is surrounded by a 6-cm wide border. What are the outside dimensions of the border?

a) Picture

$x+5$

$x$

Let $x$ be the width
Then the length is $x+5$ cm
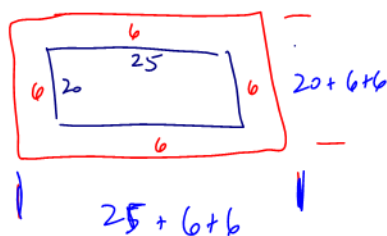
$$2(x + (x+5)) = 90$$
$$2(2x + 5) = 90$$
$$4x + 10 = 90$$
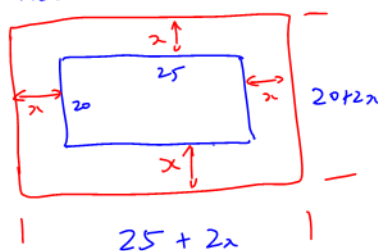$$4x = 80$$
$$x = 20$$

$\therefore$ The width is 20 cm.

b) Picture

6
25
6  20  6
6

$20 + 6 + 6$
$25 + 6 + 6$

$\therefore$ The outside dimensions are
$w = 32$cm &
$l = 37$ cm.

**38. Garden** A garden is 20 m by 25 m. It is surrounded by a walkway. The outside perimeter of the walkway is 114 m. What is the width of the walkway? Explain and justify the steps in your solution.

Picture

$x$
$25$
$x$  $20$  $x$  $20+2x$
$x$

$25 + 2x$

Let $x$ be the width of the walkway

$$2((25+2x) + (20+2x)) = 114$$
$$\Rightarrow 2(45 + 4x) = 114$$
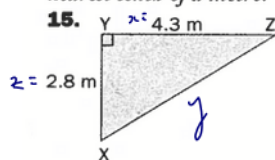$$90 + 8x = 114$$
$$8x = 114 - 90$$
$$8x = 24$$
$$x = 3$$

$\therefore$ The width of the walkway is 3m.

# Classwork (Pythagorean Theorem): Pg. 366 (#15), Pg 453

*Find the unknown side length in each triangle, to the nearest tenth of a metre.*

**15.**

Y $x = 4.3$ m Z

$z = 2.8$ m

X

$y$

$$y^2 = x^2 + z^2$$
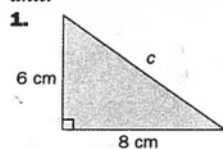$$y^2 = 4.3^2 + 2.8^2$$
$$y^2 = 18.49 + 7.84$$

$$y^2 = 26.33$$
$$\therefore y = \sqrt{26.33}$$
$$\doteq 5.1.$$

approximately
$= t o$

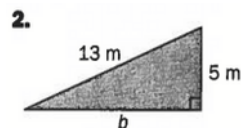*Find the unknown side length in each right triangle. If necessary, round answers to the nearest tenth of a unit.*

**1.**

6 cm

c

8 cm

$$c^2 = 6^2 + 8^2$$
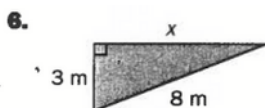$$c^2 = 36 + 64$$
$$c^2 = 100$$
$$c = \sqrt{100}$$
$$c = 10.$$

**2.**

13 m

5 m

b

$$13^2 = 5^2 + b^2$$
$$b^2 = 13^2 - 5^2$$
$$b^2 = 169 - 25$$
$$b^2 = 144$$
$$b = 12$$

**6.**

x

3 m

8 m

$$8^2 = x^2 + 3^2$$
$$x^2 = 8^2 - 3^2$$
$$x^2 = 64 - 9$$
$$x^2 = 55$$
$$x = \sqrt{55}$$
$$\doteq 7.4$$

**7.**

4 cm

x

4 cm
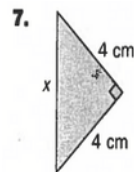
$$x^2 = 4^2 + 4^2$$
$$x^2 = 16 + 16$$
$$x^2 = 32$$
$$x = \sqrt{32}$$
$$\doteq 5.7.$$