Solving Quadratic Equations – Applications!

1) A flaming arrow is fired upward from the deck of a ship. The flaming arrow hits the water. The height **h**, in meters, of the arrow above the water **t** seconds after it is fired can be modeled by the quadratic function $\mathbf{h(t) = -4.9t^2 + 98t + 8}$

review max/min problem
a) Determine the max height of the arrow. ← complete the square
b) How long does it take the arrow to reach its max height?

solving quad equation
c) When does the arrow hit the water?
d) How high is the deck of the ship above the water?

$h = -4.9t^2 + 98t + 8$

a) $h = -4.9(t^2 - 20t) + 8$

$h = -4.9((t^2 - 20t + 100) - 100) + 8$

$h = -4.9(t - 10)^2 + 498$

a) ∴ max height of the arrow is 498m

b) ∴ max height occurs at 10 seconds

c) $0 = -4.9t^2 + 98t + 8$

$$t = \frac{-98 \pm \sqrt{98^2 - 4(-4.9)(8)}}{2(-4.9)}$$

$$t = \frac{-98 \pm 98.8}{-9.8}$$

$t = 20.08$ $\boxed{t = -0.08}$ ← inadmissable

c) ∴ the arrow hits the water after 20.08 seconds

d) $h = -4.9(0) + 98(0) + 8$

$h = 8\text{m}$

2) Find two **consecutive** whole numbers such that the **sum of their squares** is 265.

Let x and $x+1$ be the numbers

$$(x)^2 + (x+1)^2 = 265$$

$$x^2 + x^2 + 2x + 1 = 265$$

$$2x^2 + 2x - 264 = 0$$

$$2(x^2 + x - 132) = 0$$

$$x^2 + x - 132 = 0$$

$$x^2 + 12x - 11x - 132 = 0$$

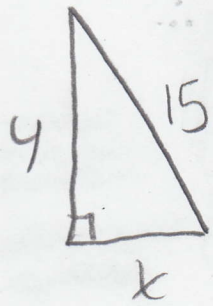
$$(x+12)(x-11) = 0$$

inad. → $x = -12 \quad x = 11$

$\therefore x = 11$

$x = 12$

3) The **perimeter** of a **right triangle** is 36.0 cm and the length of the **hypotenuse** is 15.0 cm. Determine the length of the other two sides.



Let x be the one side
Let y be the other side

$P = x + y + 15$

$36 = x + y + 15$

$21 = x + y$

$x = 21 - y$

Right $\triangle$

$x^2 + y^2 = 225$

$(21-y)^2 + y^2 = 225$

$(21-y)(21-y) + y^2 = 225$

$441 - 42y + y^2 + y^2 = 225$

$2y^2 - 42y + 216 = 0$

$y^2 - 21y + 108 = 0$

$y = 12 \quad y = 9$

$\triangle$

$x = 9$

$x = 12$

p. 178
#7-13