

Are there any Homework Questions you would like to see on the board?

pp. 161-163 #1cd, 2, 3ac, 4def, 5f, 6de, 9, 11, 13

SWYK 3.1 Tomorrow

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1. Solve.

a) $(x + 3)(x - 5) = 0$

b) $5(x - 6)(x - 9) = 0$

c) $(2x + 1)(3x - 5) = 0$

d) $2x(x - 3) = 0$

$$\begin{aligned} &\downarrow \qquad \qquad \qquad \searrow \\ &2x=0 \quad \text{or} \quad x-3=0 \\ &x=\frac{0}{2} \qquad \qquad x=3 \\ &x=0 \end{aligned}$$

2. Solve by factoring.

a) $x^2 + x - 20 = 0$

b) $x^2 = 36$

c) $x^2 + 12x = -36$

d) $x^2 = 10x$

$$\begin{aligned} &x^2 - 10x = 0 \\ &x(x - 10) = 0 \\ &\downarrow \qquad \qquad \downarrow \\ &x=0 \qquad \qquad x-10=0 \\ &\qquad \qquad \qquad x=10 \end{aligned}$$

3. Determine whether the given number is a root of the quadratic equation.

a) $x = 2; x^2 + 6x - 16 = 0$

b) $x = -4; 2x^2 - 5x - 35 = 0$

c) $x = 1; 6x^2 + 7x = x^2 + 12$

d) $x = -1; 5x^2 + 7x = 2x^2 - 6$

$$\begin{aligned} LS &= x^2 + 6x - 16 \\ &\rightarrow = (2)^2 + 6(2) - 16 \\ &= 4 + 12 - 16 \\ &= 0 \end{aligned}$$

$$RS = 0$$

$$\therefore LS = RS$$

$\therefore x = 2$ is a root.

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5. Solve by factoring. Verify your solutions.

- a) $x^2 = 289$ d) $2x^2 + 3x = 16x + 7$
 b) $9x^2 - 30x = -25$ e) $4x^2 - 5x = 2x^2 - x + 30$
 c) $x^2 - 5x = -3x + 15$ f) $x^2 + 3x + 10 = 3x^2 - 4x - 5$

$$\begin{aligned} x^2 - 3x^2 + 3x + 4(x + 10 + 5) &= 0 \\ -2x^2 + 7x + 15 &= 0 \\ -1(2x^2 - 7x - 15) &= 0 && 2x^2 - 7x - 15 \\ -1(2x + 3)(x - 5) &= 0 && = 2x^2 - 10x + 3x - 15 \\ &&& = 2x(x - 5) + 3(x - 5) \\ &&& = (x - 5)(2x + 3) \end{aligned}$$

\downarrow
 $2x + 3 = 0$ or $x - 5 = 0$
 $2x = -3$ $x = 5$
 $x = -\frac{3}{2}$

Verify $x = -\frac{3}{2}$

$$\begin{aligned} LS &= x^2 + 3x + 10 && RS = 3x^2 - 4x - 5 \\ &= \left(-\frac{3}{2}\right)^2 + 3\left(-\frac{3}{2}\right) + 10 && = 3\left(-\frac{3}{2}\right)^2 - 4\left(-\frac{3}{2}\right) - 5 \\ &= \frac{9}{4} - \frac{9}{2} + 10 && = 3\left(\frac{9}{4}\right) + 6 - 5 \\ &= \frac{9}{4} - \frac{18}{4} + \frac{40}{4} && = \frac{27}{4} + 1 \\ &= \frac{31}{4} && = \frac{27}{4} + \frac{4}{4} \\ &&& = \frac{31}{4} \end{aligned}$$

$\therefore LS = RS$
 $\therefore x = -\frac{3}{2}$ is a root.

Verify $x = 5$

6. Solve by factoring. Verify your solutions.

- a) $3x(x - 2) = 4x(x + 1)$
 b) $2x^2(x + 3) = -4x^2(x - 1)$
 c) $(x + 5)^2 - 6 = (x + 5)$
 d) $(x + 3)(x - 1) = 2(x - 5)(x + 3)$
 e) $3(x - 5)^2 = x - 5$
 f) $x^3 + 4x^2 = x^3 - 2x^2 - 17x - 5$

$$\begin{aligned} x^2 - x + 3x - 3 &= 2(x^2 + 3x - 5x - 15) \\ x^2 + 2x - 3 &= 2(x^2 - 2x - 15) \\ x^2 + 2x - 3 &= 2x^2 - 4x - 30 \\ 0 &= 2x^2 - x^2 - 4x - 2x - 30 + 3 \\ 0 &= x^2 - 6x - 27 \\ 0 &= (x - 9)(x + 3) \\ \therefore x &= 9 \text{ or } x = -3 \end{aligned}$$

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9. The area of a rectangular enclosure is given by the function $A(w) = -2w^2 + 48w$, where $A(w)$ is the area in square metres and w is the width of the rectangle in metres.
- What values of w give an area of 0?
 - What is the maximum area of the enclosure?

a) let $A(w) = 0$

$$0 = -2w^2 + 48w$$

- p. 163 11. A rock is thrown down from a cliff that is 180 m high. The function $h(t) = -5t^2 - 10t + 180$ gives the approximate height of the rock above the water, where $h(t)$ is the height in metres and t is the time in seconds. When will the rock reach a ledge that is 105 m above the water?

$$h(t) = 105$$

$$105 = -5t^2 - 10t + 180$$

$$\begin{aligned} 0 &= -5t^2 - 10t + 180 - 105 \\ &= -5t^2 - 10t + 75 \end{aligned}$$

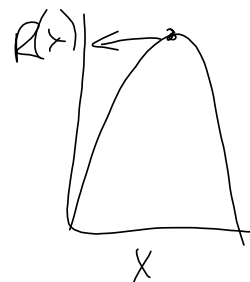
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13. The manager of a hardware store knows that the weekly revenue function for batteries sold can be modelled with $R(x) = -x^2 + 10x + 30\,000$, where both the revenue, $R(x)$, and the cost, x , of a package of batteries are in dollars. According to the model, what is the maximum revenue the store will earn?



Today's Learning Goal(s):

By the end of the class, I will be able to:

- a) Select and apply factoring and graphing strategies to solve applications involving quadratic functions

MCF 3MI

3.5 Solving Problems Involving Quadratic Functions

Date: Oct 15/19

Problems involving Quadratics can be solved using strategies such as:

- » a table of values (t-chart, or T of V)
- » graphing
- » factoring

Recall:

- "a" determines the direction of opening
 - > so it tells us if there is a maximum or minimum value
- draw a sketch of the scenario
- to find the maximum or minimum value:
 - > write the equation in standard form
 - > factor
 - > determine the zeros (aka. x -intercepts)
 - > determine the axis of symmetry
 - > sub the A.of S. into the equation to find the corresponding y -value (this is the max/min value)

Ex.1: A ball is thrown off a cliff.

The height of the ball above the ground after it is thrown is modelled by the function,

$$h(t) = -5t^2 + 10t + 175$$

where $h(t)$ is the height in metres and t is the time in seconds.

- How high is the cliff?
- When will the ball be 160 m above the ground?
- When will the ball hit the ground?
- What is the maximum height that the ball reaches?
- State the domain and range for this function.



- a) How high is the cliff?

Find $h(t)$ when $t=0$.

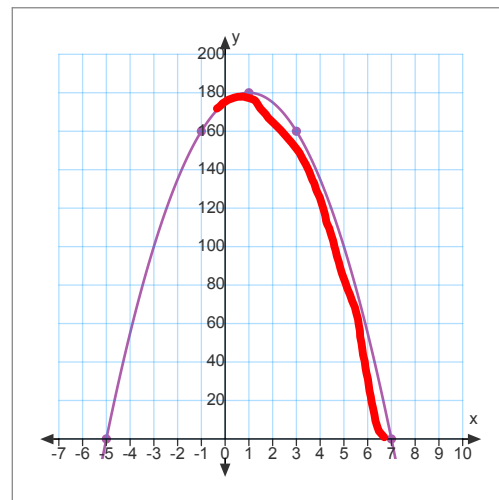
$$\begin{aligned} h(0) &= -5(0)^2 + 10(0) + 175 \\ &= 175 \end{aligned}$$

the height of the cliff is 175 m.

- b) When will the ball be 160 m above the ground?

$$\begin{aligned} h(t) &= 160 \\ 160 &= -5t^2 + 10t + 175 \\ 0 &= -5t^2 + 10t + 175 - 160 \\ &= -5t^2 + 10t + 15 \\ &= -5(t^2 - 2t - 3) \\ &= -5(t-3)(t+1) \\ \therefore t &= 3 \text{ or } t = -1 \text{ inadmissible} \end{aligned}$$

the ball will be 160 m above the ground at 3 s.



$$y = -5t^2 + 10t + 175$$

- c) When will the ball hit the ground?

$$\begin{aligned} \text{let } h(t) &= 0 \\ 0 &= -5t^2 + 10t + 175 \\ &= -5(t^2 - 2t - 35) \\ &= -5(t+5)(t-7) \\ &\quad \downarrow \\ \therefore t &= -5 \text{ or } t = 7 \end{aligned}$$

the ball will hit the ground at 7 s.

- d) What is the maximum height that the ball reaches?

find the vertex $\frac{1}{2}$ way between

$$\begin{aligned} \text{A of S: } t &= \frac{-5 + 7}{2} \\ &= \frac{2}{2} \end{aligned}$$

$$t = 1$$

$$\begin{aligned} h(1) &= -5(1)^2 + 10(1) + 175 \\ &= -5 + 10 + 175 \\ &= 180 \quad \text{V(1, 180)} \end{aligned}$$

the maximum height the ball reaches is 180 m.

- e) Domain: $\{t \in \mathbb{R} \mid 0 \leq t \leq 7\}$
Range: $\{h \in \mathbb{R} \mid 0 \leq h \leq 180\}$

Today's Assigned Practice: pp. 168-169 #1, 2, 4, 9, 10

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