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

Last day's work: pp. 182-183 # 1 – 4, 6 – 8 2bc, 4a, 7, 3d, 8
p. 184 # 1 – 8 [9, 10] 5, 7
pp. 186-188 # 1 – 15

p. 182

2. Determine the maximum or minimum of each function. occurs at the vertex.

a) $f(x) = x^2 - 2x - 35$

b) $f(x) = 2x^2 + 7x + 3$

c) $g(x) = -2x^2 + x + 15$

3. Determine the zeros and the maximum or minimum value for each function.

a) $f(x) = x^2 + 2x - 15$

b) $f(x) = -x^2 + 8x - 7$

c) $f(x) = 2x^2 + 18x + 16$

d) $f(x) = 2x^2 + 7x + 3$

e) $f(x) = 6x^2 + 7x - 3$

f) $f(x) = -x^2 + 49$

2b) $a = 2$ (positive)
$\therefore$ minimum

A of S: $x = \frac{-b}{2a} = \frac{-7}{2(2)} = \frac{-7}{4} = -1.75$

$f(-1.75) = 2(-1.75)^2 + 7(-1.75) + 3$
$= 2(3.0625) - 12.25 + 3$
$= 6.125 - 12.25 + 3$
$= -3.125$

$\therefore$ min value is -3.125

2c) a is negative
$\therefore$ max. value

A of S: $x = \frac{-b}{2a} = \frac{-1}{2(-2)} = \frac{1}{4} = 0.25$

$g(0.25) = -2(0.25)^2 + (0.25) + 15$
$= -0.125 + 0.25 + 15$
$= 15.125$

$\therefore$ max. value is 15.125

3d) zeros: $0 = 2x^2 + 7x + 3$
$0 = 2x^2 + 6x + 1x + 3$
$= 2x(x+3) + 1(x+3)$
$= (x+3)(2x+1)$
$\therefore x = -3$ or $x = \frac{-1}{2}$ are the zeros.

A of S: $x = \frac{-3 + \left(\frac{-1}{2}\right)}{2} = \frac{-\frac{6}{2} - \frac{1}{2}}{2} = \frac{\frac{-7}{2}}{2} = \frac{-7}{4}$

$f\left(\frac{-7}{4}\right) = 2\left(\frac{-7}{4}\right)^2 + 7\left(\frac{-7}{4}\right) + 3$
$= \frac{2}{1}\left(\frac{49}{16}\right) - \frac{49}{4} + 3$
$= \frac{49}{8} - \frac{98}{8} + \frac{24}{8}$
$= \frac{-25}{8}$
$= -3.125$

Same question, but I did one with fractions for you.

p. 182 **4.** The function $h(t) = 1 + 4t - 1.86t^2$ models the height of a rock thrown upward on the planet Mars, where $h(t)$ is height in metres and t is time in seconds. Use a graph to determine

a) the maximum height the rock reaches

b) how long the rock will be above the surface of Mars

$h(t) = -1.86t^2 + 4t + 1$

$\therefore a = -1.86 \quad b = 4 \quad c = 1$

a) graph using desmos

or max at vertex

$t = \frac{-b}{2a}$

$= \frac{-(4)}{2(-1.86)}$

$\doteq 1.0752$

$h(1.0752)$

$\doteq -1.86(1.0752)^2 + 4(1.0752) + 1$

$\doteq 3.150$

$\therefore$ the max. height is 3.15 m

p. 182 **7.** A firecracker is fired from the ground. The height of the firecracker at a given time is modelled by the function $h(t) = -5t^2 + 50t$, where $h(t)$ is the height in metres and t is time in seconds. When will the firecracker reach a height of 45 m?

Let $h(t) = 45$

$\therefore 45 = -5t^2 + 50t$

$5t^2 - 50t + 45 = 0$

$5(t^2 - 10t + 9) = 0$

$5(t-1)(t-9) = 0$

$t = 1$ or $t = 9$

$\therefore$ the firecracker reaches a height of 45 m at 1 sec. (on the way up) AND at 9 sec. (on the way down).

p. 183 **8.** The population of a city, $P(t)$, is given by the function $P(t) = 14t^2 + 820t + 42\,000$, where t is time in years. *Note:* $t = 0$ corresponds to the year 2000.

a) When will the population reach 56 224? Provide your reasoning.

b) What will the population be in 2035? Provide your reasoning.

b) → let $t = 35$

$P(35) = 14(35)^2 + 820(35) + 42\,000$

$= 14(1225) + 28\,700 + 42\,000$

$= 17\,150 + 28\,700 + 42\,000$

$= 87\,850$

a) $P(t) = 56\,224$

$\therefore 56\,224 = 14t^2 + 820t + 42\,000$

$0 = 14t^2 + 820t + 42\,000 - 56\,224$

$0 = 14t^2 + 820t - 14\,224$

$= 2(7t^2 + 410t - 7112)$

← I know it factors, but it will take too long. $\therefore$ Quadratic Formula

$a = 7 \quad b = 410 \quad c = -7112$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(410) \pm \sqrt{410^2 - 4(7)(-7112)}}{2(7)}$$

$$= \frac{-410 \pm \sqrt{367\,236}}{14}$$

$$= \frac{-410 \pm 606}{14}$$

$t = \frac{-410 - 606}{14}$ or $t = \frac{-410 + 606}{14}$

$= \frac{-1016}{14} \qquad = \frac{196}{14}$

$= \frac{-508}{7} \qquad = 14$

inadmissible

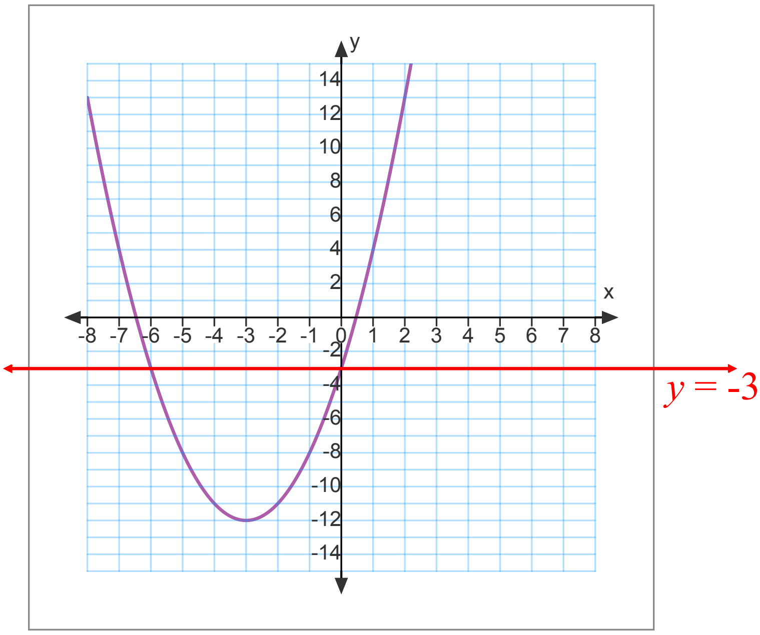
$\therefore$ year $= 2000 + 14$

$\therefore$ 2014 is the year when the population will reach 56 224.

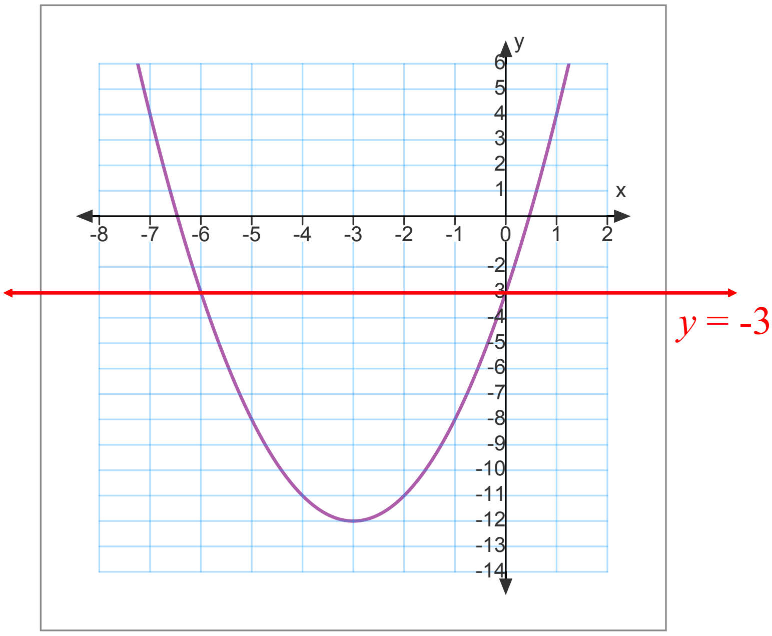
p. 184 **5.** Solve by graphing.

a) $x^2 + 6x - 3 = -3$

$y = x^2 + 6x - 3$ $\quad$ $y = -3$



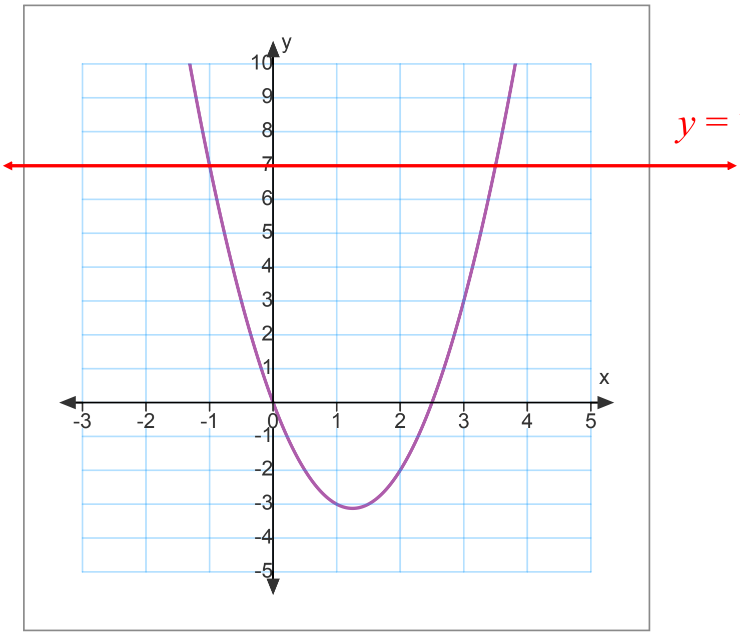
$y = x^2 + 6x - 3$



p. 184 **5.** Solve by graphing.

b) $2x^2 - 5x = 7$

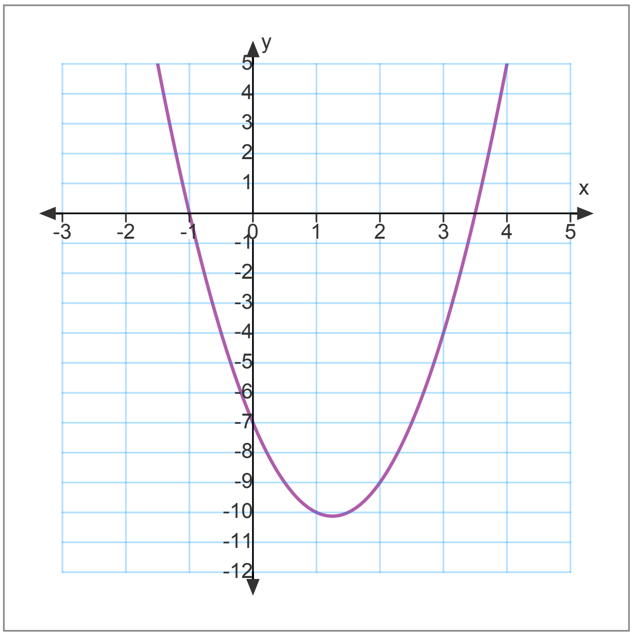
$y = 2x^2 - 5x$ $y = 7$



$y = 7$

y :

$y = 2x^2 - 5x - 7$



p. 184 **7.** The population of a town, $P(t)$, is modelled by the function $P(t) = 6t^2 + 110t + 3000$, where t is time in years. *Note:* $t = 0$ represents the year 2000.

a) When will the population reach 6000?

b) What will the population be in 2030?

a) Set $P(t) = 6000$

$\therefore 6000 = 6t^2 + 110t + 3000$

$0 = 6t^2 + 110t + 3000 - 6000$

$= 6t^2 + 110t - 3000$

$= 2(3t^2 + 55t - 1500)$

$= 2[3t^2 - 45t + 100t - 1500]$

$= 2[3t(t-15) + 100(t-15)]$

$= 2(t-15)(3t+100)$

$t = 15$ or $t = \frac{-100}{3}$

inadmissible

$\therefore$ the population will reach 6000 in the year 2015.

b) $t = 30$

$\therefore P(30) = 6(30)^2 + 110(30) + 3000$

$= 6(900) + 3300 + 3000$

$= 5400 + 6300$

$= 11700$

S: +55

P: −4500

1, 4500

⋮

−45, 100

$\therefore$ in 2030, the population will be 11700.

MCF 3MI Lesson 3_R2

Unit 3 - REVIEW 2

Date: Oct. 18/19

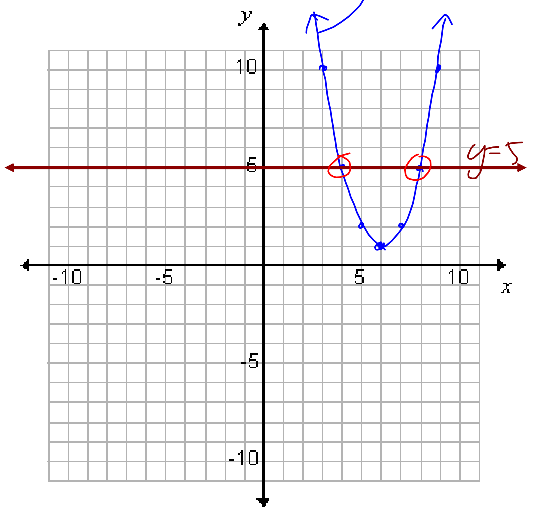
Solving Quadratic Equations by Graphing (Lesson 3_3)

Ex. 1 Determine the solutions to the quadratic equation $x^2 - 12x + 37 = 5$ by graphing.
[Keep in mind we are looking for the values of $\boldsymbol{x}$ that satisfy this equation.]

Method 1 split the equation and graph the related functions on the same grid.

$$y_1 = x^2 - 12x + 37 \qquad y_2 = 5$$

The solutions to the original equation are the x values of the points of intersection of the two functions.



$y_1 = x^2 - 12x + 37$

A of S: $x = \frac{-b}{2a}$

$= \frac{-(-12)}{2(1)}$

$= \frac{12}{2}$

$x = 6$

$\therefore V(6, 1)$

if $x = 6$

$y = (6)^2 - 12(6) + 37$

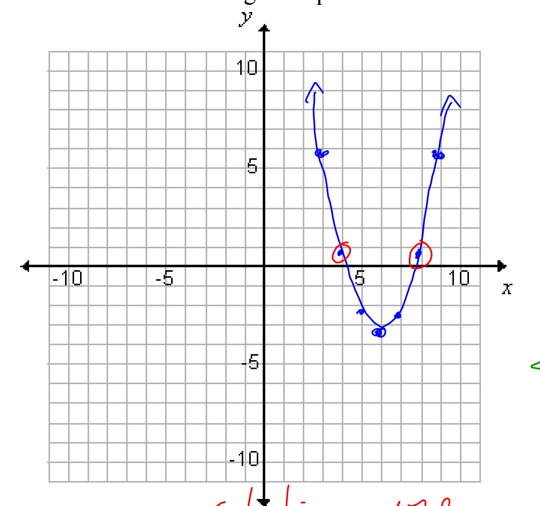
$= 36 - 72 + 37$

$= 1$

$y = 5$ (hor. line)

$\therefore$ Solutions are $x = 4$ & $x = 8$

Method 2 rearranged the equation and set it equal to zero.
Then graph the related quadratic function to determine the solutions to the quadratic equation.
The solutions to the original equation are the *x-intercepts* of the new function.



$\therefore$ Solutions are $x = 4$ & $x = 8$

$y_1 = x^2 - 12x + 37 \qquad y_2 = 5$

$x^2 - 12x + 37 = 5$

$x^2 - 12x + 37 - 5 = 0$

$x^2 - 12x + 32 = 0$

$\therefore y = x^2 - 12x + 32$

$= x^2 - 12x + 6^2 - 6^2 + 32$

$= x^2 - 12x + 36 - 36 + 32$

$= (x - 6)^2 - 4$

$V(6, -4)$

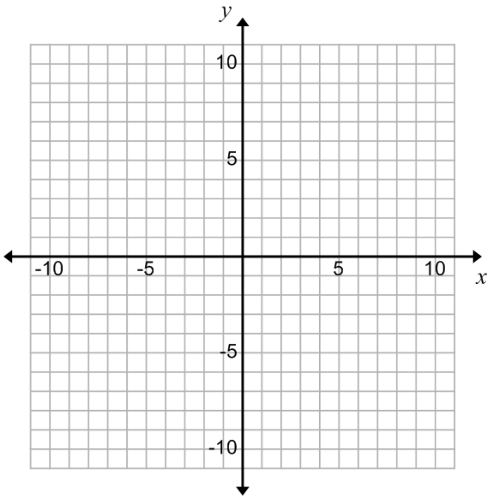
$\left(\frac{1}{2}b\right)^2$

$= \left[\frac{1}{2}(-12)\right]^2$

$= (-6)^2$

$= 36$

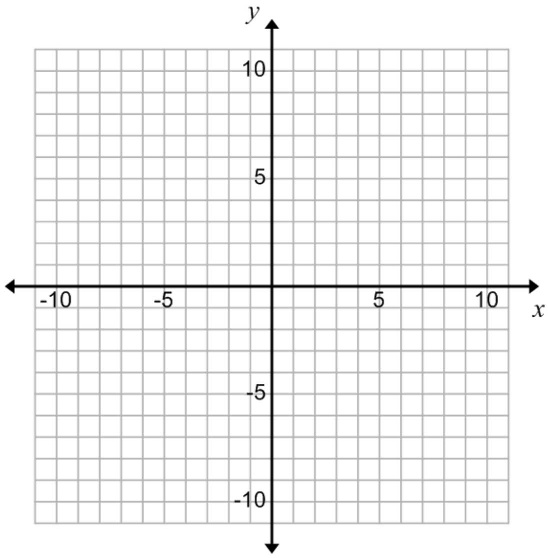
2a) Sketch $f(x) = (x-2)^2 - 7$



b) Write $f(x) = (x-2)^2 - 7$ in standard form.

c) Can $f(x) = x^2 - 4x - 3$ be written in factored form?

3a) Sketch $f(x) = (x-4)(x+2)$



b) Sketch $g(x) = 3(x-5)(x-7)$