Chapter 7 Questions

1) Complete the table of values for the given quadratic function. Then, graph the points from the table of values.

$y = x^2 - 4x + 3$

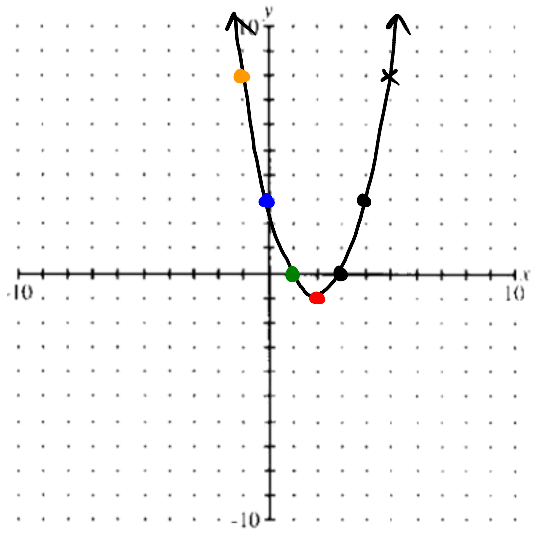
x	y
-1	8
0	3
1	0
2	-1
3	0
4	3

$y = (-1)^2 - 4(-1) + 3$
$y = 1 + 4 + 3$
$y = 8$

$y = (0)^2 - 4(0) + 3$
$y = 0 + 0 + 3$
$y = 3$

$y = (1)^2 - 4(1) + 3$
$y = 1 - 4 + 3$
$y = 0$

$y = (2)^2 - 4(2) + 3$
$y = 4 - 8 + 3$
$y = -1$



2) Which of the following relations are quadratic? ← must have "x^2" term when in standard form (nothing bigger)
Circle all of the quadratic relations.

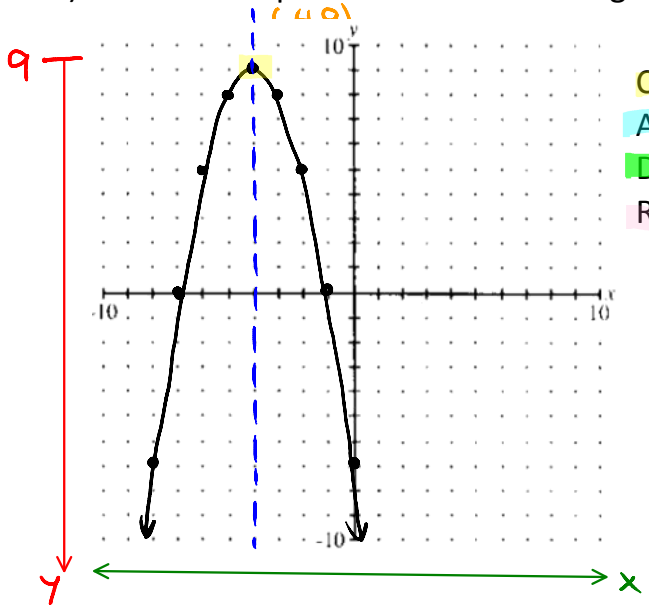
a) $y = x^2 + 4$ ✓
b) $y = 2(x + 4)$
c) $y = 2x(x + 4)$
d) $y = (x + 1)^2$
e) $y = 2x + 4$
f) $y = 2x^3 + 3x^2 - 4$ ← can't have "x^3"

b) $y = 2(x+4)$
$y = 2x + 8$ ×

c) $y = 2x(x+4)$
$y = 2x^2 + 8x$ ✓

d) $y = (x+1)^2$
$y = (x+1)(x+1)$
$y = x^2 + 2x + 1$ ✓

3) Answer the questions based on the graph of the quadratic function. (4 marks)



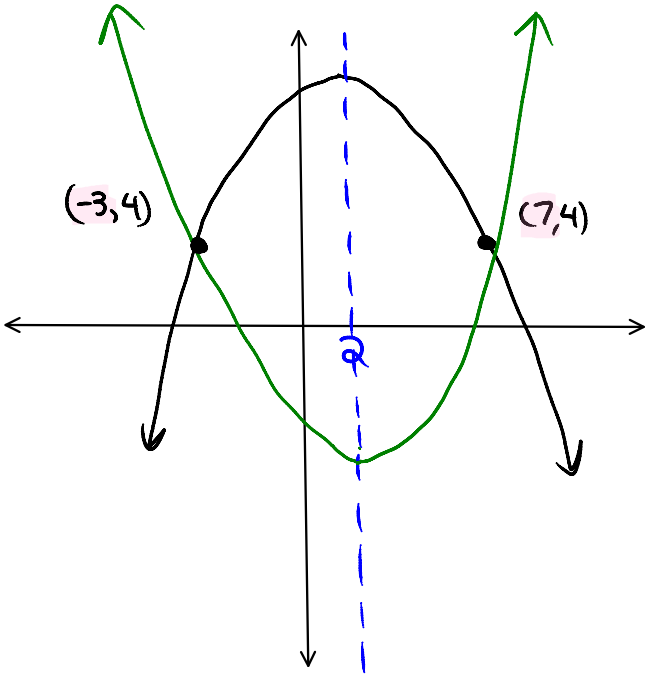
Coordinates of the vertex: (-4, 9)
Axis of symmetry: $x = -4$
Domain: $x \in R$
Range: $y \leq 9$

4) For the following functions, state the direction of opening (up or down) and the y-intercept.

$y = ax^2 + bx + c$

$y = 2x^2 - 7x - 10$	$y = 4x - 3x^2$	$y = (x-4)^2 - 9$
$a = 2$ ← positive	$y = -3x^2 + 4x + 0$	$y = (x-4)(x-4) - 9$
	$a = -3$ ← negative	$y = x^2 - 8x + 16 - 9$
		$y = x^2 - 8x + 7$
		$a = 1$ ← positive
Opens: up	Opens: down	Opens: up
y-intercept: -10	y-intercept: 0	y-intercept: 7

5) The points (7, 4) and (-3, 4) are on the same parabola. Determine the equation equation of the axis of symmetry.



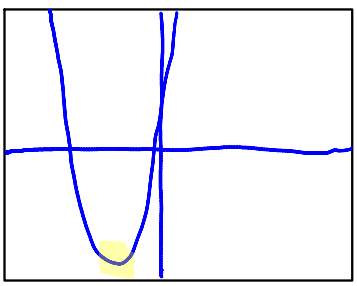
$\frac{-3+7}{2} = \frac{4}{2} = 2$

Answer: $x = 2$

6) With a graphing calculator, determine the coordinates of the vertex for the given function. Round your answer to 2 decimal places.

$f(x) = 2x^2 + 9x + 2$

2nd trace minimum



left bound enter
right bound enter
guess enter

[-10, 10] and [-10, 10]
xmin xmax ymin ymax

Vertex: (-2.25, -8.13)

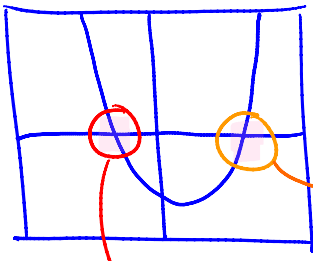
7) Represent the quadratic equation in standard form. Then solve the equation in standard form by graphing. Round your answer(s) to 2 decimal places if necessary.

$0.5x^2 + 2x = 4x + 5$

$-4x \quad -5 \qquad -4x \quad -5$

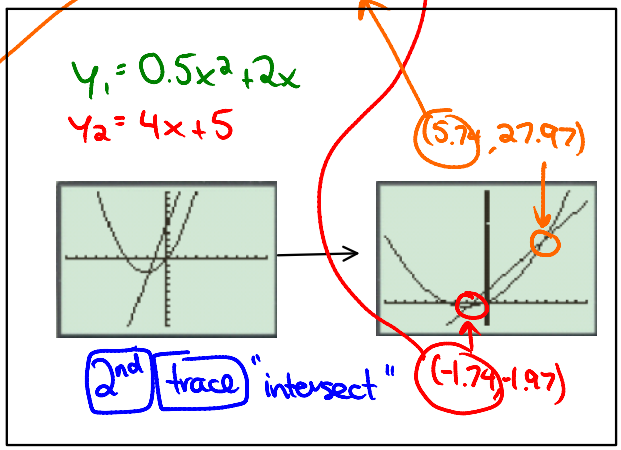
$0.5x^2 - 2x - 5 = 0$

graph to determine the value of "x" that makes the value of the function equal 0



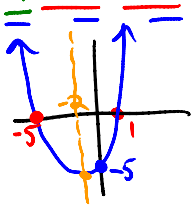
Solution(s): $x = -1.74$

$x = 5.74$



8) For each quadratic function in factored form, determine:
a) The direction of opening (up/down)
b) The x-intercepts of the graph.
c) The y-intercept of the graph.
d) The equation of the axis of symmetry.

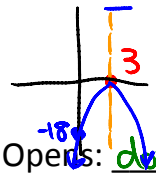
$y = (x-1)(x+5)$



Opens: up (opposites)
x-intercept(s): $x = 1, -5$
y-intercept: $1 \cdot -1 \cdot 5 = -5$
Axis of symm.: $x = -2$

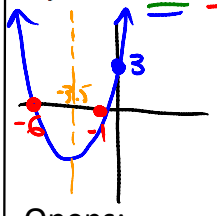
$f(x) = -2(x-3)^2$

$f(x) = -2(x-3)(x-3)$



Opens: down
x-intercept(s): $x = 3$
y-intercept: $-2 \cdot -3 \cdot -3 = -18$
Axis of symm.: $x = 3$

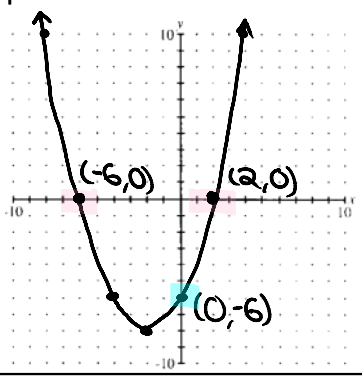
$f(x) = 0.5(x+1)(x+6)$



$\frac{-1-6}{2} = \frac{-7}{2} = -3.5$

Opens: up
x-intercept(s): $x = -1, -6$
y-intercept: $0.5 \cdot 1 \cdot 6 = 3$
Axis of symm.: $x = -3.5$

9) Determine the function **in factored form** ($y = a(x-r)(x-s)$) that defines the parabola below.



x-ints → $y = a(x+6)(x-2)$

sub $(0,-6)$ to determine 'a'

$-6 = a(0+6)(0-2)$

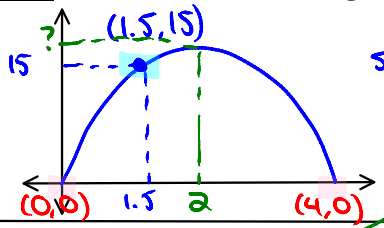
$-6 = a(6)(-2)$

$\frac{-6}{-12} = \frac{-12a}{-12}$ $\quad a = 0.5 \sim \frac{1}{2}$

Answer: $y = 0.5(x+6)(x-2)$

10) A soccer ball was kicked from the ground. The soccer ball reached a height of 15 m after 1.5 s of flight. The soccer ball was in the air for 4 s.

a) Sketch a diagram of the soccer ball's path **and** determine the quadratic function **in factored form** that models the height of the soccer ball over time.



x-int → $y = a(x-0)(x-4)$

sub $(1.5,15)$ → $15 = a(1.5-0)(1.5-4)$

$\frac{15}{-3.75} = \frac{-3.75a}{-3.75}$ $\quad a = -4$

Answer: $y = -4(x-0)(x-4)$

b) Determine the maximum height of the soccer ball (1 mark).

Occurs when $x = 2$

$y = -4(2-0)(2-4)$

$y = -4 \cdot 2 \cdot -2 = 16\text{m}$

11) Solve by factoring. Then, check your solutions.

$x^2 + 5x + 6 = 0$

$(x+2)(x+3) = 0$

$x+2=0$ $\quad x+3=0$

$-2 \quad -2$ $\quad -3 \quad -3$

$x = -2$ $\quad x = -3$

Check

$(-2)^2 + 5(-2) + 6 = 0?$

$4 - 10 + 6 = 0$

$0 = 0$ ✓

$(-3)^2 + 5(-3) + 6 = 0?$

$9 - 15 + 6 = 0$

$0 = 0$ ✓

12) Solve each equation by factoring.

$x^2 - 7x = 8$

$x^2 - 7x - 8 = 0$

$(x+1)(x-8) = 0$

$x+1=0$ $\quad x-8=0$

$x=-1$ $\quad x=8$

$4x^2 - 9 = 0$

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

$2x+3=0$ $\quad 2x-3=0$

$2x=-3$ $\quad 2x=3$

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

$6x^2 - 3x = 0$ GCF = $3x$

$3x(2x-1) = 0$

$3x=0$ $\quad 2x-1=0$

$x=0$ $\quad 2x=1$

$x=\frac{1}{2}$

13) Juliette sells newspapers. The profit function for her business is $P(n) = -0.5n^2 + 6n - 10$ where n is the number of newspapers sold per month, in hundreds, and P(n) is the profit, in thousands of dollars.

a) How many newspapers must Juliette sell per month to break even? $P(n)=0$

$0 = -0.5n^2 + 6n - 10$

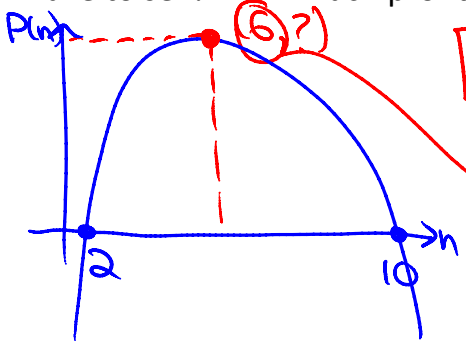
$0 = -0.5(n^2 - 12n + 20)$

$0 = -0.5(n-2)(n-10)$

$n=2$ $\quad n=10$

∴ Juliette must sell 200 or 1000 papers

b) In order to maximize her profit, how many newspapers would Juliette have to sell? How much profit would she earn if she sold this many newspapers?



would have to sell 600 newspapers

$P(n) = -0.5n^2 + 6n - 10$

$P(n) = -0.5(6)^2 + 6(6) - 10$

$P(n) = -0.5(36) + 36 - 10$

$P(n) = -18 + 36 - 10$

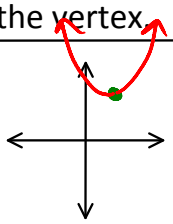
$P(n) = 8$

profit would be $8000

14) For each quadratic function in **vertex form**, $y = a(x-h)^2 + k$, determine:
a) The direction of opening (up/down)
b) The coordinates of the vertex.

$y = 1(x-3)^2 + 5$

opp ↑ ↑ (3,5)

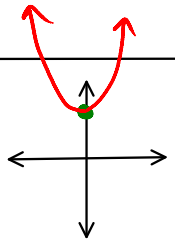


Opens: up

Coords. of vertex: (3,5)

$y = \frac{1}{2}x^2 + 7$

↑ ↑ (0,7)



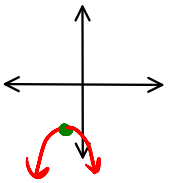
Opens: up

Coords. of vertex: (0,7)

15) For each quadratic function in **vertex form**, $y = a(x-h)^2 + k$, determine:
a) The coordinates of the vertex.
b) The number of x-intercepts (either 0, 1, or 2)
c) The value of the y-intercept.

$y = -2(x+1)^2 - 4$

opens down — opp



$y = -2(0+1)^2 - 4$
$y = -2(1)^2 - 4$
$y = -2 - 4 = -6$

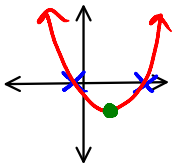
Coords. of vertex: (-1,-4)

Number of x-intercepts: 0

y-intercept: occurs when x=0, y=-6

$y = 0.5(x-2)^2 - 1$

opens up — opp



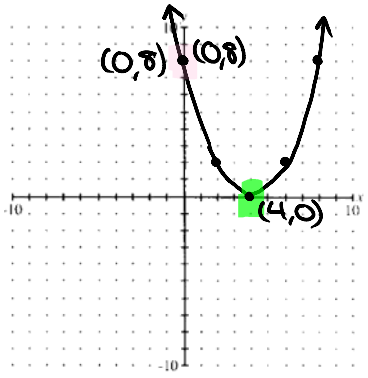
$y = 0.5(0-2)^2 - 1$
$y = 0.5(-2)^2 - 1$
$y = 0.5(4) - 1$
$y = 2 - 1 = 1$

Coords. of vertex: (2,-1)

Number of x-intercepts: 2

y-intercept: 1 or (0,1)

16) Determine the **vertex form**, $y = a(x-h)^2 + k$, from the graph



from vertex → $y = a(x-4)^2 + 0$

sub (0,8) (x, y) → $8 = a(0-4)^2 + 0$

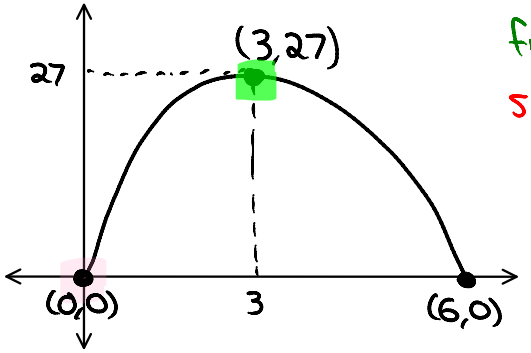
$8 = a(-4)^2 + 0$

$\frac{8}{16} = \frac{16a}{16}$

$a = \frac{8}{16}$ or $\frac{1}{2}$

Answer: $y = \frac{1}{2}(x-4)^2$

17) A water rocket is launched from the ground. It lands back on the ground after 6 s after reaching a maximum height of 27 m. Determine the ~~specific~~ quadratic function in **vertex form** that models the height of the water rocket.



from vertex → $y = a(x-3)^2+27$

sub (0,0) → $0 = a(0-3)^2+27$

$0 = a(-3)^2+27$

$0 = 9a+27$

$-27 \quad -27$

$\frac{-27}{9} = \frac{9a}{9}$

$a = -3$

Answer: $y = -3(x-3)^2+27$

18) Solve each quadratic equation using the quadratic formula. Express your solution(s) to 2 decimal places if necessary.

$x^2 - 5x - 3 = 0$

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

$x = \frac{-(-5) \pm \sqrt{(-5)^2-4\cdot1\cdot-3}}{2\cdot1}$

$x = \frac{5 \pm \sqrt{25+12}}{2}$

$x = \frac{5 \pm \sqrt{37}}{2}$ → $\frac{5-\sqrt{37}}{2} = -0.54$

$\frac{5+\sqrt{37}}{2} = 5.54$

$2x^2 = 3x - 5$

$-3x+5 \quad -3x+5$

$2x^2 - 3x + 5 = 0$

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

$x = \frac{-(-3) \pm \sqrt{(-3)^2-4\cdot2\cdot5}}{2\cdot2}$

$x = \frac{3 \pm \sqrt{9-40}}{4}$

$x = \frac{3 \pm \sqrt{-31}}{4}$ ← no solution, can't sq root a negative!

19) Solve. State your solution(s) as an exact value in simplest form.

no decimals

$9x^2 - 12x + 4 = 0$

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

$x = \frac{-(-12) \pm \sqrt{(-12)^2-4\cdot9\cdot4}}{2\cdot9}$

$x = \frac{12 \pm \sqrt{144-144}}{18}$

$x = \frac{12 \pm \sqrt{0}}{18}$ → $\frac{12-\sqrt{0}}{18} = \frac{12}{18} = \frac{2}{3}$

$\frac{12+\sqrt{0}}{18} = \frac{12}{18} = \frac{2}{3}$

$3x^2 + 2x = 1$

$3x^2 + 2x - 1 = 0$

$x = \frac{-2 \pm \sqrt{(2)^2-4\cdot3\cdot-1}}{2\cdot3}$

$x = \frac{-2 \pm \sqrt{4+12}}{6}$

$x = \frac{-2 \pm \sqrt{16}}{6}$

$x = \frac{-2 \pm 4}{6}$ → $\frac{-2-4}{6} = \frac{-6}{6} = -1$

$\frac{-2+4}{6} = \frac{2}{6} = \frac{1}{3}$

$\frac{-2+4}{6} = \frac{2}{6} = \boxed{\frac{1}{3}}$