

Period: \_\_\_\_\_

Name: \_\_\_\_\_

Key

Chapter 3 Assignment- Quadratics

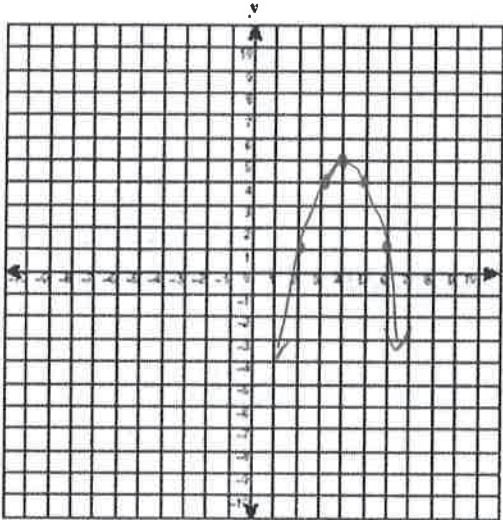
/44

Show all of your work.

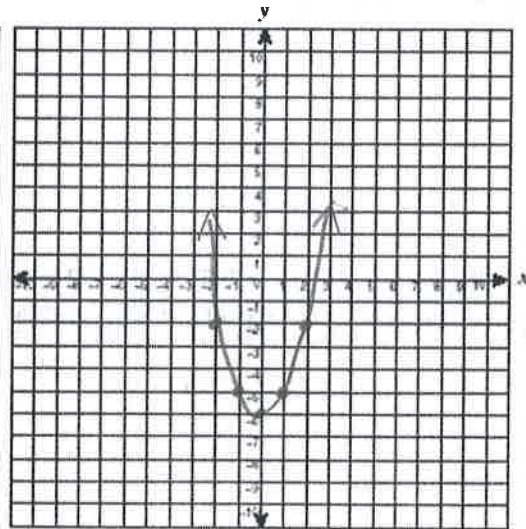
1) Accurately sketch each graph (2), then list the vertex, axis of symmetry equation, max/min, domain, and range (0.5 marks each):

a)  $y = -(x - 4)^2 + 5$

b)  $y = x^2 - 6$



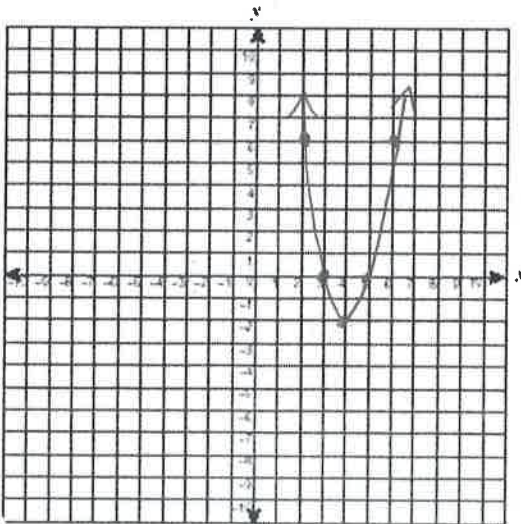
vertex:  $(4, 5)$   
 axis of sym equation:  $x = 4$   
 max/min:  $y = 5$   
 domain:  $x \in \mathbb{R}$   
 range:  $y \leq 5$



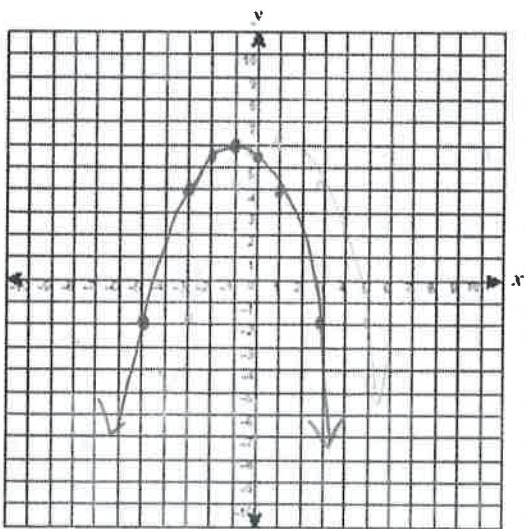
vertex:  $(0, -6)$   
 axis of sym equation:  $x = 0$   
 max/min:  $y = -6$   
 domain:  $x \in \mathbb{R}$   
 range:  $y \geq -6$

c)  $y = 2(x - 4)^2 - 2$

d)  $y = 6 - \frac{1}{2}(x + 1)^2 + 6$



vertex:  $(4, -2)$   
 axis of sym equation:  $x = 4$   
 max/min:  $y = -2$   
 domain:  $x \in \mathbb{R}$   
 range:  $y \geq -2$



vertex:  $(-1, 6)$   
 axis of sym equation:  $x = -1$   
 max/min:  $y = 6$   
 domain:  $x \in \mathbb{R}$   
 range:  $y \leq 6$

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2) Without graphing, write an equation for a parabola with vertex (6, 4) passing through the point (4, 6) (2 marks).

$$y = a(x-6)^2 + 4$$

$$6 = a(4-6)^2 + 4$$

$$2 = a(-2)^2 \quad a = \frac{1}{2}$$

$$2 = 4a$$

ANSWER:

$$y = \frac{1}{2}(x-6)^2 + 4$$

3) Determine the number of x-intercepts for each quadratic function (1 mark each):

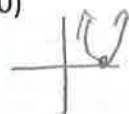
a) range of  $y \geq -1$



ANSWER:

2 solutions

b) vertex of (8, 0)



ANSWER:

1 solution

4) Change each standard form equation into vertex form by completing the square. For part c), you must complete the square using fractions, not decimals.

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

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

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

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

b)  $y = -3x^2 - 21x - 26$  (3 marks)

$$y = -3(x^2 + 7x) - 26$$

$$= -3(x^2 + 7x + 12.25 - 12.25) - 26$$

$$= -3(x^2 + 7x + 12.25) - 26 + 36.75$$

$$= -3(x + 3.5)^2 + 10.75$$

ANSWER to a):

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

ANSWER to b):

$$y = -3(x+3.5)^2 + 10.75$$

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

$$y = 3(x^2 - \frac{2}{3}x) + 5$$

$$= 3(x^2 - \frac{2}{3}x + \frac{1}{9} - \frac{1}{9}) + 5$$

$$= 3(x^2 - \frac{2}{3}x + \frac{1}{9}) + 5 - \frac{3}{9}$$

$$= 3(x - \frac{1}{3})^2 + \frac{45}{9} - \frac{3}{9}$$

$$= 3(x - \frac{1}{3})^2 + \frac{42}{9}$$

ANSWER to c):

$$y = 3(x - \frac{1}{3})^2 + \frac{14}{3}$$

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5) The path of a rocket is described by the function  $h(t) = -4.9(t - 4)^2 + 105$  where  $h(t)$  is the height in metres and  $t$  is time in seconds since the rocket was fired.

a) What is the maximum height reached by the rocket, and how long after it's fired does it reach the maximum height (1 mark)?

vertex (4, 105)

ANSWERS:

Max height: 105m

time to reach max: 4s

b) To the nearest hundredth, how high was the rocket above the ground when it was fired (1 mark)?  $t=0$

$$\begin{aligned} h(0) &= -4.9(0-4)^2 + 105 \\ &= -4.9(16) + 105 \\ &= 26.6 \text{ m} \end{aligned}$$

ANSWER: 26.60m

c) To the nearest tenth, how many seconds after it was fired did the rocket hit the ground? (2 marks)

$$\begin{aligned} h(t) &= 0 \\ 0 &= -4.9(t-4)^2 + 105 \\ -105 &= \frac{-4.9(t-4)^2}{-4.9} \\ 21.42857 &= (t-4)^2 \\ t-4 &= \sqrt{21.42857} \\ t-4 &= 4.6291 \\ t &= 8.6291 \end{aligned}$$

ANSWER: 8.6s

d) To the nearest metre, find the height of the rocket 3 seconds after it was thrown. At this point, was the rocket on its way up or way down (2 marks)?  $t=3$

$$\begin{aligned} h(3) &= -4.9(3-4)^2 + 105 \\ &= -4.9(1)^2 + 105 \\ &= 100.1 \text{ m} \end{aligned}$$



ANSWER:

height: 100 m

up or down: UP

6) A theatre company has 400 season ticket subscribers. The board of directors has decided to raise the price of a season ticket from the current price of \$500. A survey of the subscribers has determined that for every \$20 increase in price, 10 subscribers would not renew their season tickets. What price would maximize the revenue from season tickets, and what would the maximum revenue be (4 marks)?

$$\begin{aligned}
 R &= (500 + 20x)(400 - 10x) \\
 &= 200000 - 5000x + 8000x - 200x^2 \\
 &= -200x^2 + 3000x + 200000 \\
 &= -200(x^2 - 15x + 56.25 - 56.25) + 200000 \\
 &= -200(x^2 - 15x + 56.25) + 200000 + 11250
 \end{aligned}$$

$$\begin{aligned}
 \text{price} &= 500 + 20x \\
 \text{quantity} &= 400 - 10x
 \end{aligned}$$

$$\begin{aligned}
 -\frac{15}{2} &= -7.5 \\
 \left(-\frac{15}{2}\right)^2 &= 56.25
 \end{aligned}$$

$$\begin{aligned}
 \text{PRICE} &= 500 + 2(7.5) \\
 &= \underline{\underline{650}}
 \end{aligned}$$

$$\boxed{R = -200(x - 7.5)^2 + 211,250} \quad \text{MAX @ } (7.5, 211250)$$

SENTENCE ANSWER:

The price to maximize revenue is \$650 and the revenue would be \$211,250.

7) A farmer wants to make a rectangular corral along the side of a large barn and has enough materials for 80m of fencing. Only three sides must be fenced, since the barn wall will form the fourth side. What are the dimensions the farmer should use so that the maximum area is enclosed, and what is that maximum area (4 marks)?



$$\begin{aligned}
 P &= 2x + y & A &= xy \\
 80 &= 2x + y \\
 y &= 80 - 2x
 \end{aligned}$$

$$\begin{aligned}
 A &= x(80 - 2x) \\
 &= 80x - 2x^2 \\
 &= -2x^2 + 80x
 \end{aligned}$$

$$\begin{aligned}
 -\frac{40}{2} &= -20 \\
 \left(-\frac{40}{2}\right)^2 &= 400
 \end{aligned}$$

$$\begin{aligned}
 &= -2(x^2 - 40x + 400 - 400) \\
 &= -2(x^2 - 40x + 400) + 800 \\
 A &= -2(x - 20)^2 + 800
 \end{aligned}$$

$$\begin{aligned}
 \boxed{x = 20} \\
 y &= 80 - 2(20) \\
 &= 80 - 40 \\
 \boxed{y = 40}
 \end{aligned}$$

$$\begin{aligned}
 \text{MAX} & \quad (20, 800) \\
 & \quad (x, R)
 \end{aligned}$$

SENTENCE ANSWER: The farmer should make the fence 20m by 40m and would get an Area of 800 m<sup>2</sup>