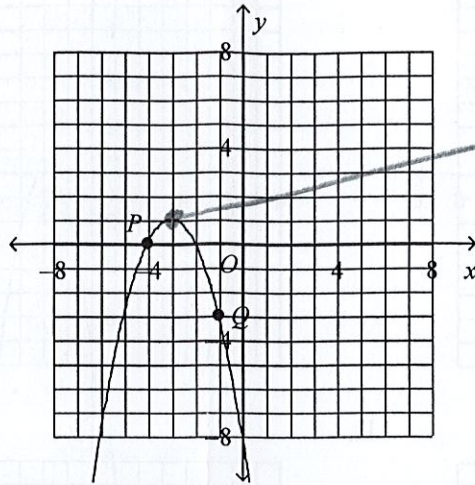


Quadratic Functions and Systems Practice Test

Key

Identify the vertex and the axis of symmetry of the parabola.

1.



vertex \rightarrow (highest or lowest point)
 $(-3, 1)$
 vertex

the axis of symmetry is equal to the x-value -3

2. Dalco Manufacturing estimates that its weekly profit, P , in hundreds of dollars, can be approximated by the formula $P = -3x^2 + 6x + 10$, where x is the number of units produced per week, in thousands.

a. How many units should the company produce per week to earn the maximum profit?

find vertex $\frac{-b}{2a} = \frac{-6}{2(-3)} = \frac{-6}{-6} = 1$

plug 1 into function

$$-3(1)^2 + 6(1) + 10 = 13$$

$(1, 13)$

b. Find the maximum weekly profit. (in thousands)

\$1300

Rewrite the equation in vertex form.

3. $y = x^2 - 8x + 4$

$$\begin{aligned} y - 4 &= x^2 - 8x \\ y - 4 + 16 &= x^2 - 8x + 16 \\ y + 12 &= (x - 4)^2 \\ y &= (x - 4)^2 - 12 \end{aligned}$$

Step 1: Put in $y = ax^2 + bx$ form (get rid of 4)
 Step 2: take half of b value, square it, add it to both sides
 Step 3: factor
 Step 4: Solve for y

Rewrite the equation in standard form.

4. $y = -2(x - 3)^2 - 4$

$$\begin{aligned} (x - 3)(x - 3) \\ x^2 - 3x - 3x + 9 \\ -2(x^2 - 6x + 9) - 4 \\ -2x^2 + 12x - 18 - 4 \end{aligned}$$

Step 1: multiply binomial (foil $(x - 3)(x - 3)$)
 Step 2: Combine like terms
 Step 3: Distribute
 Step 4: Combine like terms

$$y = -2x^2 + 12x - 22$$

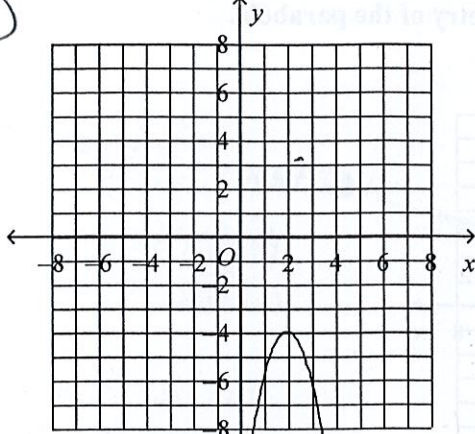
With vertex form, the vertex is h, k

vertex
 $(2, -4)$

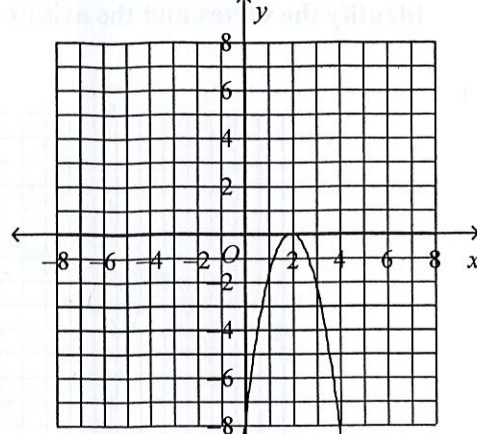
The a value is negative, therefore the parabola opens downward

5. Which is the graph of $y = -2(x - 2)^2 - 4$?

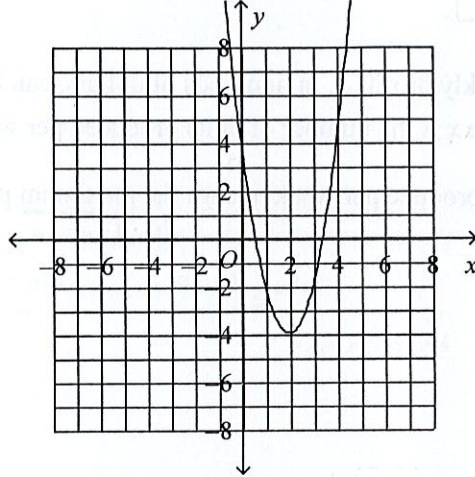
A.



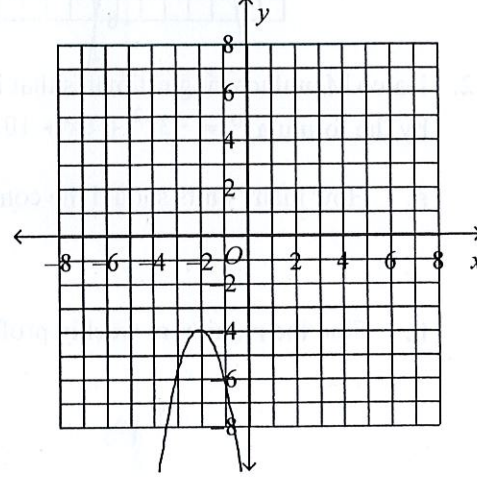
C.



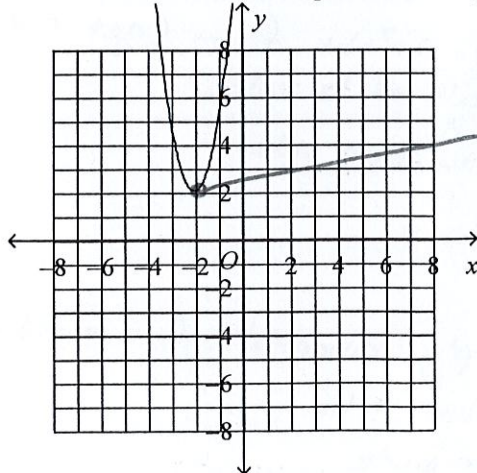
B.



D.



6. Use vertex form to write the equation of the parabola.



Find vertex

$(-2, 2)$

When finding the equation, think opposite sign of 1st point

$(2, 2)$

A. $y = 3(x - 2)^2 + 2$

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

C. $y = 3(x + 2)^2 + 2$



7. The function $y = -16t^2 + 486$ models the height y in feet of a stone t seconds after it is dropped from the edge of a vertical cliff. How long will it take the stone to hit the ground? Round to the nearest hundredth of a second.

- A. 7.79 seconds
 B. 11.02 seconds
 C. 0.25 seconds
 D. 5.51 seconds

You are looking for x -intercepts here; it can be found by factoring, quadratic equation or completing the square.

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{0 \pm \sqrt{0^2 - 4(-16)(486)}}{2(-16)}$$

$$= \frac{0 \pm \sqrt{31104}}{-32}$$

$$\frac{0 + 176.3632615}{-32}$$

-5.51 (no negative time)

$$\frac{0 - 176.3632615}{-32}$$

5.51 seconds

Rewrite the equation in vertex form.

8. $y = x^2 + 10x + 16$

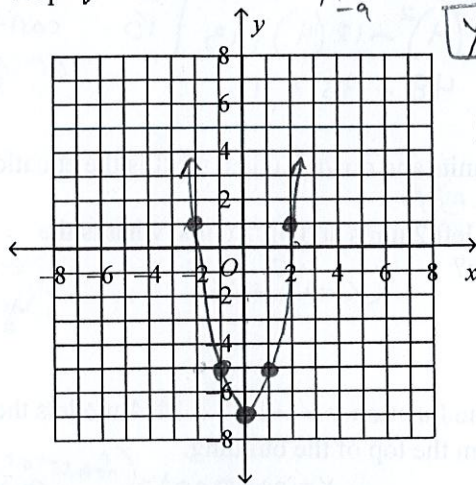
$$y - 16 = x^2 + 10x + 25$$

$$y + 9 = x^2 + 10x + 25$$

$$y - 9 = (x + 5)^2 - 9$$

$$y = (x + 5)^2 - 9$$

9. Graph $y = 2x^2 - 7$.



find vertex $\frac{-b}{2a} = 0$

plug 0 into function

$$2(0)^2 - 7 = (0, -7)$$

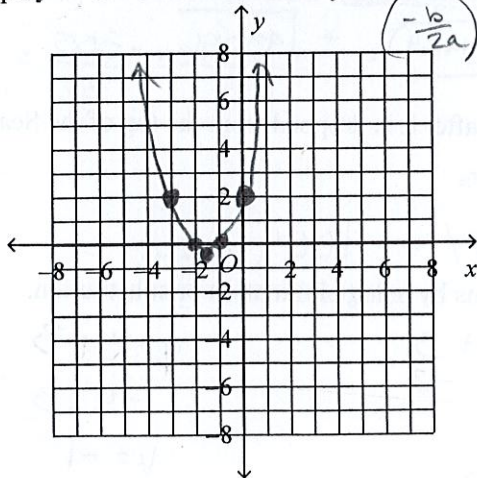
vertex

find 2 x-values

x	$2x^2 - 7$	y
1	$2(1)^2 - 7 = -5$	-5
2	$2(2)^2 - 7 = 1$	1

reflect points

10. Graph $y = x^2 + 3x + 2$. Identify the vertex and the axis of symmetry.



$$\left(\frac{-b}{2a}\right)$$

$$\left(\frac{-b}{2a}\right)$$

axis of symmetry

$$\frac{-b}{2a} = \frac{-3}{2} = -1.5 \text{ plug in value}$$

$$x^2 + 3x + 2$$

$$(-1.5)^2 + 3(-1.5) + 2 = -2.25$$

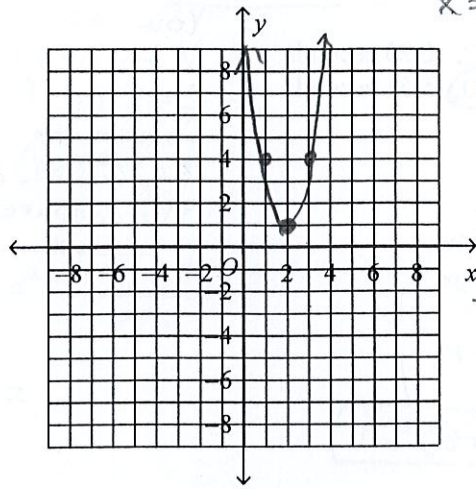
vertex

$$(-1.5, -2.25)$$

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

plot points then reflect points

11. Graph $y = 3x^2 - 12x + 13$. What is the minimum value of the function? Be sure to graph 5 specific points.



$$x = \frac{-b}{2a} = \frac{-(-12)}{2(3)} = \frac{12}{6} = 2 \quad \text{plug 2 into function}$$

$$3(2)^2 - 12(2) + 13$$

vertex (2, 1)

$$12 - 24 + 13$$

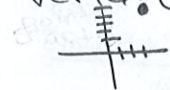
$$-12 + 13$$

1

x		
3	$3(3)^2 - 12(3) + 13$	4
	$27 - 36 + 13$	
4	$3(4)^2 - 12(4) + 13$	13
	$48 - 48 + 13$	

can't graph point on graph given

First, think about the vertex (3, 5)



Moving to units right would be 3+2 which makes 5; currently at 5 but moving down 7 would

put you at $5 - 7 = -2$ equation

$$(x-5)^2 - 2$$

12. Use the graph of $y = (x-3)^2 + 5$.

a. If you translate the parabola to the right 2 units and down 7 units, what is the equation of the new parabola in vertex form? $(x-5)^2$

b. If you translate the original parabola to the left 2 units and up 7 units, what is the equation of the new parabola in vertex form?

$$(x-1)^2 + 12$$

currently at 3, 5 moving left + 2, you have 1 and 5 + 7 is 12

13. The Sears Tower in Chicago is 1454 feet tall. The function $y = -16t^2 + 1454$ models the height y in feet of an object t seconds after it is dropped from the top of the building.

a. After how many seconds will the object hit the ground? Round your answer to the nearest tenth of a second.

$$\frac{\pm \sqrt{0^2 - 4(-16)(1454)}}{2(-16)} = \frac{\pm \sqrt{93056}}{-32} = \frac{-305}{-32} = 9.53$$

← x-intercepts (factor or quadratic equation or complete square)

b. What is the height of the object 5 seconds after it is dropped from the top of the Sears Tower?

Plug in 5 seconds

$$y = -16(5)^2 + 1454 = 1054 \text{ feet}$$

only want positive result

14. Solve the following linear-quadratic systems by using elimination or substitution.

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

$$\begin{array}{r} x^2 + 3x - 5 = x + 3 \\ -x - 3 \quad -x - 3 \end{array}$$

$$\begin{array}{r} y = x + 3 \\ -4 + 3 \end{array}$$

$$\begin{array}{r} y = x + 3 \\ = 2 + 3 \end{array}$$

$$y = x + 3$$

$$\begin{array}{r} x^2 + 2x - 8 = 0 \\ (x+4)(x-2) = 0 \end{array}$$

$$y = -1$$

$$y = 5$$

$$x = -4 \quad x = 2$$

plug each into an equation (-4, -1)

$$(2, 5)$$

15. Solve the following linear-quadratic systems by using elimination or substitution.

$$\begin{array}{r} y = x^2 - 4x + 6 \\ y = x + 2 \end{array}$$

$$\begin{array}{r} x^2 - 4x + 6 = x + 2 \\ -x \quad -x \end{array}$$

$$\begin{array}{r} y = x + 2 \\ = 4 + 2 \end{array}$$

$$\begin{array}{r} y = x + 2 \\ = 1 + 2 \end{array}$$

$$\begin{array}{r} x^2 - 5x + 6 = 2 \\ -2 \quad -2 \end{array}$$

$$y = 6$$

$$y = 3$$

$$x^2 - 5x + 4 = 0$$

$$(4, 6)$$

$$(1, 3)$$

$$(x-4)(x-1) = 0$$

$$\begin{array}{r} x-4=0 \quad x-1=0 \\ x=4 \quad x=1 \end{array}$$

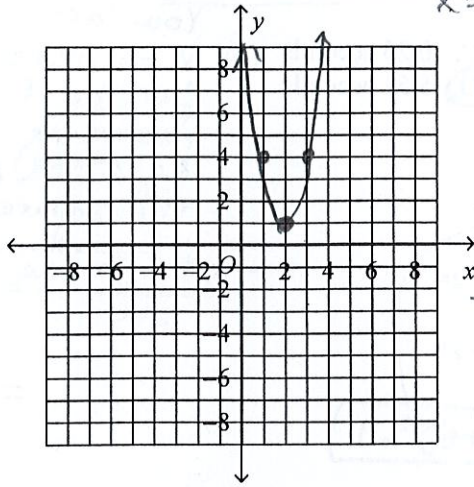
plug into equation

- ① set equations equal to each other
- ② get one side equal to zero
- ③ factor
- ④ solve for x
- ⑤ Plug both x-values into same equation

DOES NOT MATTER WHICH EQUATION

- ⑥ solve for y

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vertex (2, 1)

$$12 - 24 + 13$$

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1

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$$(x - 5)^2 - 2$$

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$$\begin{aligned} x^2 + 3x - 5 &= x + 3 \\ -x - 3 & \quad -x - 3 \end{aligned}$$

$$\begin{aligned} y &= x + 3 \\ -4 + 3 & \end{aligned}$$

$$\begin{aligned} y &= x + 3 \\ &= 2 + 3 \end{aligned}$$

$$y = x + 3$$

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

$$(x + 4)(x - 2) = 0$$

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$$(2, 5)$$

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$$y = x^2 - 4x + 6$$

$$y = x + 2$$

$$\begin{aligned} x^2 - 4x + 6 &= x + 2 \\ -x & \quad -x \end{aligned}$$

$$\begin{aligned} x^2 - 5x + 6 &= 2 \\ -2 & \quad -2 \end{aligned}$$

$$x^2 - 5x + 4 = 0$$

$$(x - 4)(x - 1) = 0$$

$$x - 4 = 0 \quad x - 1 = 0$$

$$x = 4 \quad x = 1$$

plug into equation

$$\begin{aligned} y &= x + 2 \\ &= 4 + 2 \end{aligned}$$

$$y = 6$$

$$(4, 6)$$

$$\begin{aligned} y &= x + 2 \\ &= 1 + 2 \end{aligned}$$

$$y = 3$$

$$(1, 3)$$

① set equations equal to each other

② set one side equal to zero

③ factor

④ solve for x

⑤ Plug both x-values into same equation

DOES NOT MATTER WHICH EQUATION

⑥ solve for y