Section: 7.4 **Objective:** Find the key features of graphs from their equations. Draw graphs from their key features. Match graphs to their equations.

For each function, fill out the requested information. Put a star by any information that can be seen just from looking at the equation. Graph the equation using its key features. Graph at least 5 points.

A. $f(x) = x^2 - 3x - 4$

1) Form: standard

2) a = 1, b = -3, c = -4

3) Direction of opening: up
a is positive

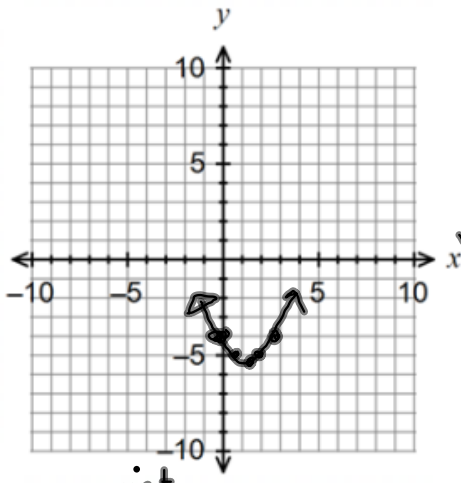
4) Zeros: -1 ; 4

5) x-intercepts: (-1,0); (4,0)

6) y-intercept: -4 (0,-4)

7) Axis of symmetry: $x = \frac{3}{2}$

8) Vertex: $(\frac{3}{2}, -6.25)$
1.5



x	$f(x)$
0	-4
1	-6
$\frac{3}{2}$	-6.25
2	-6
3	-4

Show work here:

$x^2 - 3x - 4$

	x	1
x	x^2	$1x$
-4	$-4x$	-4

-4 | -3
1 | -4 | $1 + -4 =$
2 | -2 | $2 + -2$

$x^2 - 3x - 4$
$0^2 - 3(0) - 4$
Let $x = 0$

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

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

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

vertex
$x^2 - 3x - 4$
$x = \frac{-b}{2a} \quad \frac{3}{2(1)} = \frac{3}{2}$ or 1.5
$1.5^2 - 3(1.5) - 4 = -6.25$

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

1) Form: vertex

2) $a =$ -2, $h =$ -3, $k =$ -2

3) Direction of opening: down
a is negative

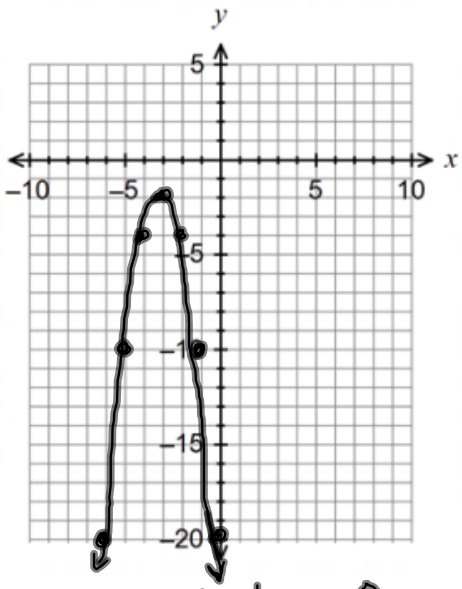
4) Zeros: $-3 \pm 1i$

5) x-intercepts: none

6) y-intercept: (0, -20)

7) Axis of symmetry: $x = -3$

8) Vertex: (-3, -2)
(h, k)



x	y
-6	-20
-5	-10
-4	-4
-3	-2
-2	-4
-1	-10
0	-20

Show work here:

$-2(x+3)^2 - 2 = 0$
$+2 \quad +2$

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

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

$\sqrt{(x+3)(x+3)} = \pm\sqrt{-1}$

$x + 3 = \pm i\sqrt{1}$

$x + 3 = \pm 1i$
$-3 \quad -3$

$x = -3 \pm 1i$

y int Let x=0

$-2(0+3)^2 - 2 = -20$

C. $f(x) = -\frac{1}{4}(x+2)(x-6)$

1) Form: factored

2) a = $-\frac{1}{4}$, p = -2, q = 6

3) Direction of opening: down
a is negative

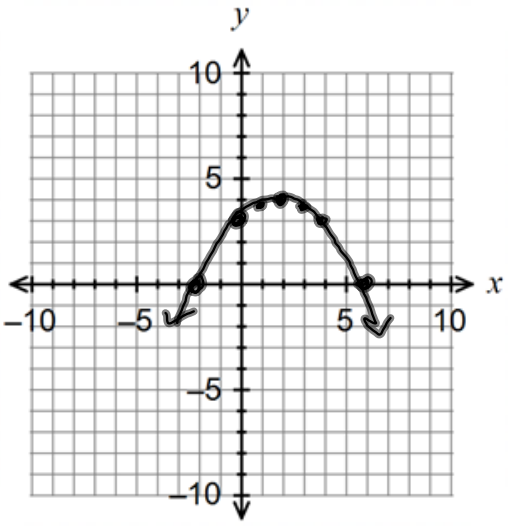
4) Zeros: -2 ; 6

5) x-intercepts: $(-2,0)$ $(6,0)$

6) y-intercept: $(0,3)$

7) Axis of symmetry: $x=2$

8) Vertex: $(2,4)$



x	$f(x)$
0	3
1	3.75
2	4
3	3.75
4	3

Show work here:

zeros

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

$x=-2$

$x-6=0$ $\quad +6 \quad +6$

$x=6$

vertex

$x = \frac{(p+q)}{2}$ $\quad \frac{(-2+6)}{2}$ $\quad \frac{4}{2}=2$

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

y int Let $x=0$

$-\frac{1}{4}(0+2)(0-6)=3$

D. $y = x^2 - 9$

$x^2 + 0x - 9$

vertex
$1(x-0)^2 - 9$
$a=1 \quad h=0 \quad k=-9$

1) Form: Standard

2) $a =$ 1, $b =$ 0, $c =$ -9

3) Direction of opening: up
a is positive

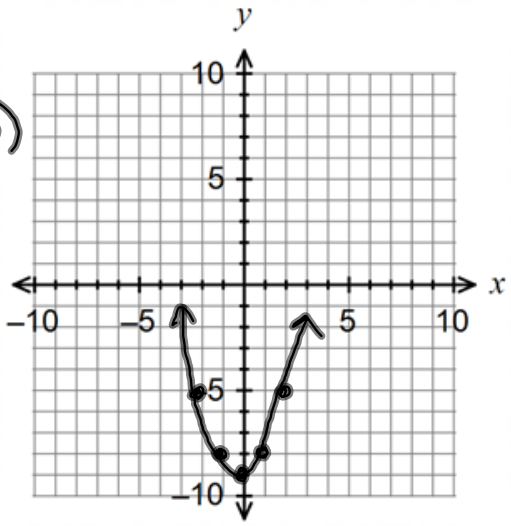
4) Zeros: 3; -3

5) x-intercepts: (3,0) (-3,0)

6) y-intercept: (0,-9)

7) Axis of symmetry: x=0

8) Vertex: (0, -9)



x	y
-2	-5
-1	-8
0	-9
1	-8
2	-5

Show work here:

$x^2 - 9 = 0$

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

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

$+3 \quad +3 \quad -3 \quad -3$

$x = 3 \quad x = -3$

y int
Let x=0
$0^2 - 9$

vertex
$\frac{-b}{2a} \quad \frac{0}{2(1)} = \frac{0}{2}$

0

E. $f(x) = 3x^2 - 6x - 9$

1) Form: Standard

2) a = 3, b = -6, c = -9

3) Direction of opening: up
a is positive

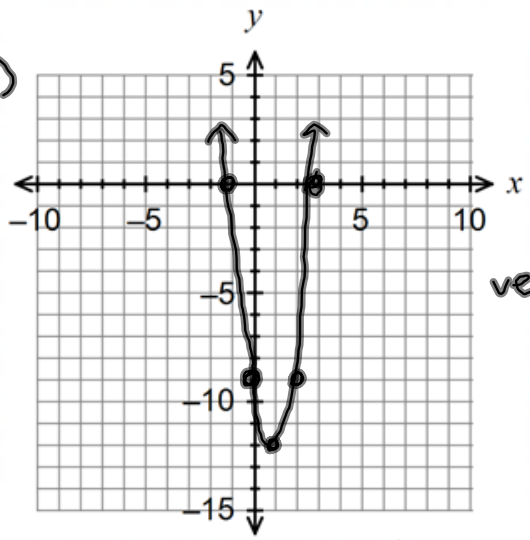
4) Zeros: -1, 3

5) x-intercepts: (-1,0)(3,0)

6) y-intercept: (0, -9)
(0,"c")

7) Axis of symmetry: x = 1

8) Vertex: (1, -12)



x	$f(x)$
-1	0
0	-9
1	-12
2	-9
3	0

vertex

Show work here:

$3x^2 - 6x - 9$

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

-3 | -2
1 · -3 | 1 + -3

vertex

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

x | 1

x^2	$1x$
$-3x$	-3

x
-3

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

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

$-1 \quad -1$ $\quad +3 \quad +3$

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

1) Form: factored

2) $a = -1$, $(x-0)(x+4) = $ ____, ____ = ____

3) Direction of opening: down

4) Zeros: -1 p 0 q -4

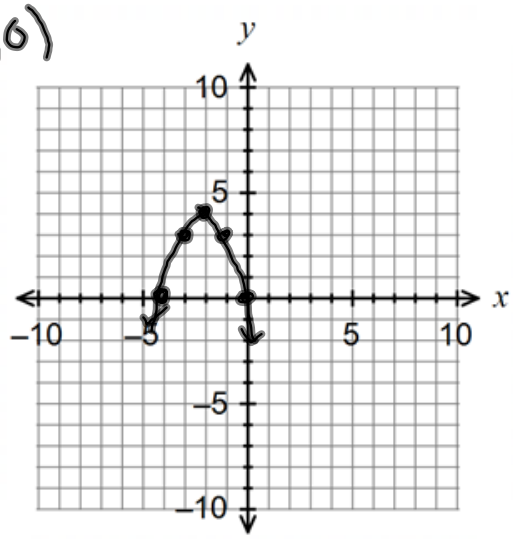
5) x-intercepts: 0 ; -4

6) y-intercept: $(0,0)$ $(-4,0)$

7) Axis of symmetry: $(0,0)$

8) Vertex: $x=-2$

Show work here: $(-2, 4)$



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

yint let x=0

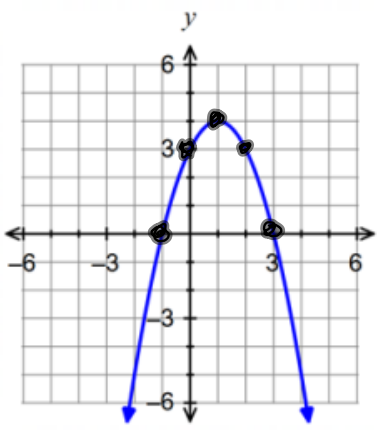
$-0(0+4)$

vertex

$\frac{(p+q)}{2}$ $\frac{0+-4}{2} = -2$

EXAMPLE: Given the graph, write the equation.

A. Write the equation of the graph in factored form.



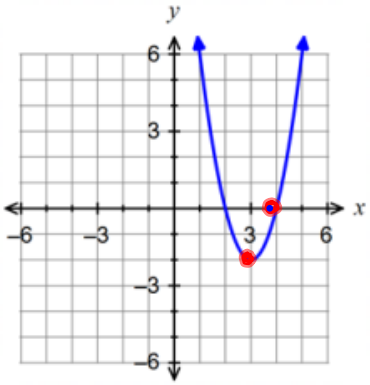
Direction of opening: down

Find the zeros: −1, 3

$a =$ −1 $p =$ −1 $q =$ 3

Equation in factored form: $y = -1(x+1)(x-3)$

B. Write the equation of the graph in vertex form.



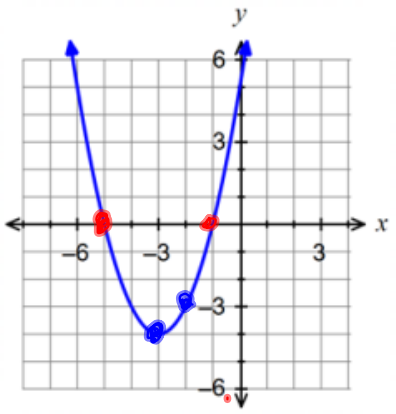
Direction of opening: up

Vertex: (3, −2)

$a =$ 2 $h =$ 3 $k =$ −2

Equation in vertex form: $y = 2(x-3)^2 - 2$

C. Write the equation of the graph in standard form.

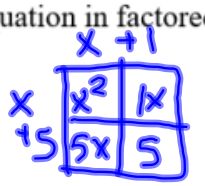


Direction of opening: up

Find the zeros: −1 ; −5

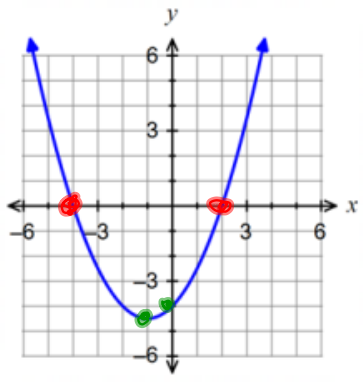
$a =$ 1 $p =$ −1 $q =$ −5

Equation in factored form: $y = 1(x+1)(x+5)$



Equation in standard form: $y = x^2 + 6x + 5$

D. Write the equation of the graph in factored form.



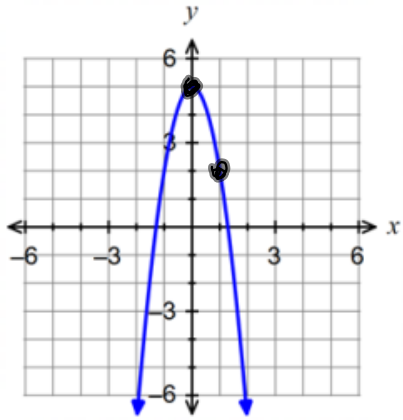
Direction of opening: up

Find the zeros: 2 ; −4

$a =$ $\frac{1}{2}$ $p =$ 2 $q =$ −4

Equation in factored form: $y = \frac{1}{2}(x-2)(x+4)$

E. Write the equation of the graph in vertex form.



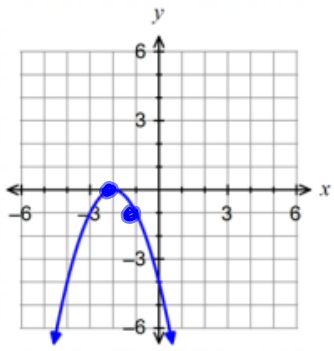
Direction of opening: down

Vertex: (0, 5)

$a = -3$ $h = 0$ $k = 5$

Equation in vertex form: $y = -3(x-0)^2+5$

F. Write the equation of the graph in standard form.



Direction of opening: down

Find the zeros: -2

$a = -1$ $p = -2$ $q = -2$

Equation in factored form: $y = -1(x+2)(x+2)$

Equation in standard form: $y = -1(x^2+4x+4)$

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

	x	+2
x	x^2	+2x
+2	2x	4