

Match each equation with its graph:

1) $y = x^2 - 3$ Graph: _____

↑
Shift down 3

2) $y = (x - 3)^2$ Graph: _____

↑
Shift right 3

3) $y = (x + 3)^2$ Graph: _____

$(x - -3)^2$
↑
Shift left 3

4) $y = -x^2 + 3$ Graph: _____

Reflect over x-axis
↑
Shift up 3

5) $y = 3x^2$ Graph: _____

↑
Vertical stretch by 3

E

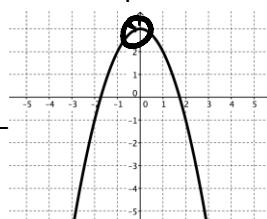
D

B

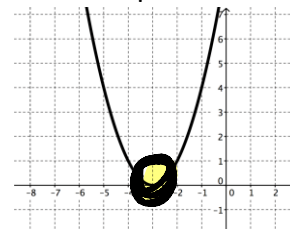
A

C ✓

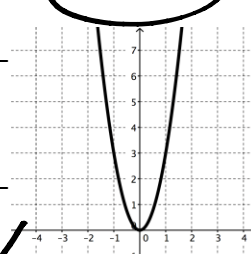
Graph A



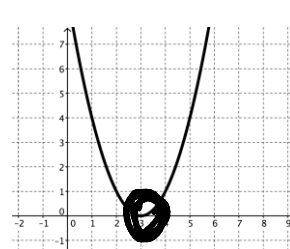
Graph B



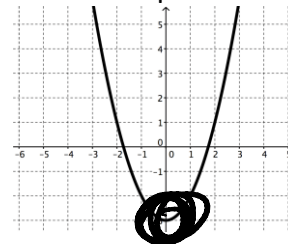
Graph C



Graph D



Graph E



Find the missing term to make the following expression a perfect square trinomial:

6) $x^2 - 20x$ _____

$(x - 10)^2$

7) $x^2 + 4x$ _____

$(x + 2)^2$

8) $x^2 + 11x$ _____

$(x + \frac{11}{2})^2$

9) $x^2 + \frac{1}{4}x$ _____

$(x + \frac{1}{8})^2$

10) $x^2 - \frac{3}{5}x$ _____

$(x - \frac{3}{10})^2$

11) $x^2 + \frac{2}{3}x$ _____

$(x + \frac{1}{3})^2$

$\frac{x}{3} \cdot \frac{1}{3}$

Complete the square to put each of the following equations into vertex form:

12) $f(x) = x^2 + 12x + 6$

$= (x^2 + 12x + 36) + 6 - 36$

$f(x) = (x + 6)^2 - 30$

13) $g(x) = x^2 - 7x - 5$

$= (x^2 - 7x + \frac{49}{4}) - 5 - \frac{49}{4}$

$= (x - \frac{7}{2})^2 - \frac{20}{4} - \frac{49}{4}$

$g(x) = (x - \frac{7}{2})^2 - \frac{69}{4}$

14) $h(x) = 2x^2 - 10x + 5$

$= (2x^2 - 10x + \frac{25}{2}) + 5 - \frac{25}{2}$

$= 2(x^2 - 5x + \frac{25}{4}) + \frac{10}{2} - \frac{25}{2}$

$h(x) = 2(x - \frac{5}{2})^2 - \frac{15}{2}$

15) $k(x) = -3x^2 + 12x + 1$

① Units $= (-3x^2 + 12x - 12) + 1 + 12$

② ECF $= -3(x^2 - 4x + 4) + 13$

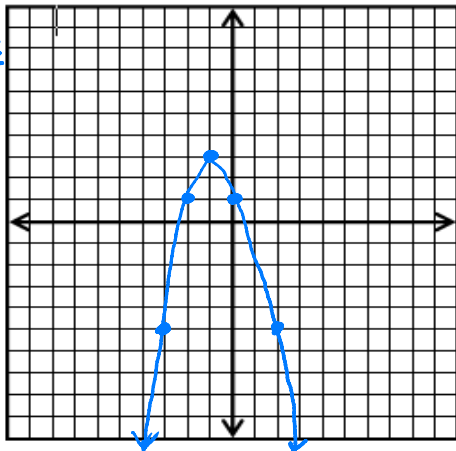
③ Complete the square $y = -3(x - 2)^2 + 13$

Graph each of the following. (Include at least two accurate points on either side of the line of symmetry.) State the vertex, axis of symmetry, and the transformations of parent function.

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

$a=1$
+1
+3
+5

$a=-2$
-2
-6
-10



Vertex: $(-1, 3)$

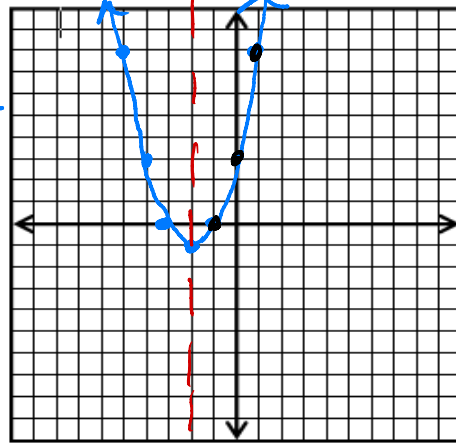
Axis of Symmetry: $x = -1$

Transformations from $y = x^2$:

shifted left 1
& up 3

17) $y = x^2 + 4x + 3$

$a=1$
+1
+3
+5



Vertex: $(-2, -1)$

Axis of Symmetry: $x = -2$

Transformations from $y = x^2$:

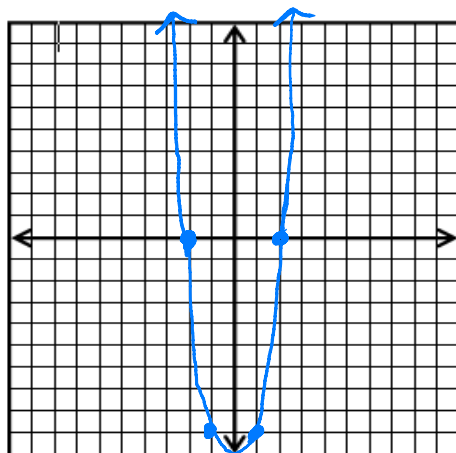
shift left 2, down 1

factored
 $y = (x+1)(x+3)$
x-int
 $(-1, 0)$ $(-3, 0)$
a.o.s. $x = -2$
Vertex $(-2, -1)$
 $f(-2) = (-1)(1)$
 $= -1$

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

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

18) $y = 3(x - 2)(x + 2)$



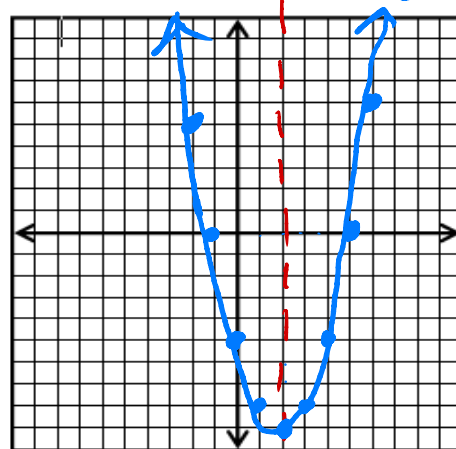
Vertex: $(0, -12)$ $f(0) = 3(-2)(2)$

Axis of Symmetry: $x = 0$

Transformations from $y = x^2$:

• vertical stretch by 3
• shift down 12

19) $y = x^2 - 4x - 5$



Vertex: $(2, -9)$

Axis of Symmetry: $x = 2$

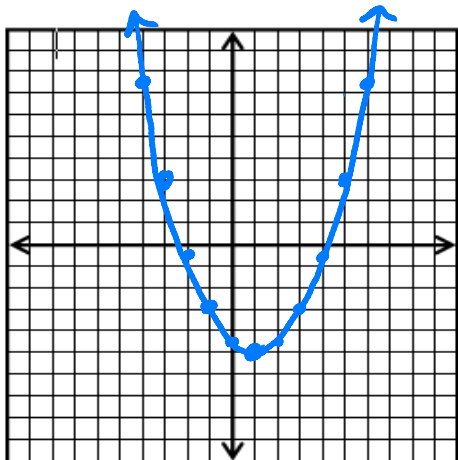
Transformations from $y = x^2$:

• shift right 2
& down 9

factored form
 $y = (x-5)(x+1)$
x-int
 $(5, 0)$ $(-1, 0)$
a.o.s.
 $x = \frac{5+1}{2}$
 $x = 2$
Vertex
 $(2, -9)$
 $f(2) = (-3)(3)$

Vertex form
 $y = (x-2)^2 - 9$

20) $y = \frac{1}{2}(x-1)^2 - 5$



Vertex: (1, -5)

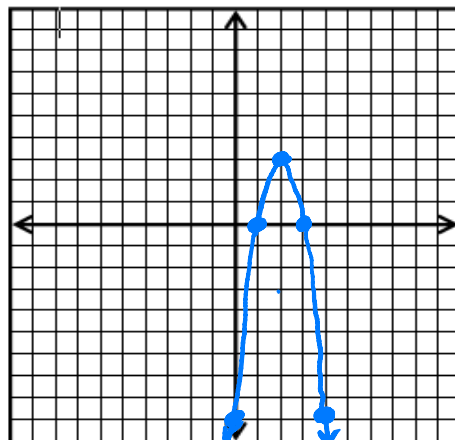
Axis of Symmetry: X=1

Transformations from $y = x^2$:

- Vertical shrink by $\frac{1}{2}$
- Shift right 1, down 5

$y = (-3x^2 + 12x - 12) - 9 + 12$
 $y = -3(x^2 - 4x + 4) + 3$
 $y = -3(x-2)^2 + 3$

21) $y = -3x^2 + 12x - 9$



Vertex: (2, 3)

Axis of Symmetry: X=2

Transformations from $y = x^2$:

- reflect over x-axis
- vertical stretch by 3
- shift right 2 and up 3

Factored Form
 $y = -3(x^2 - 4x + 3)$

$y = -3(x-1)(x-3)$

x-int
 (1, 0) & (3, 0)

y-int (0, -9)

Vertex form

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

Match each standard form equation with its equivalent vertex form equation in column A and its factored form equation from column B.

$y = a(x-h)^2 + k$

Column A	Column B	Standard Form (Question)	Vertex Form (Column A)	Factored Form (Column B)
d	a	22) $y = x^2 - 4x - 12$	a. $y = (x-4)^2 - 4$	a. $y = (x+2)(x-6)$
c	d	23) $y = x^2 + 4x - 12$	b. $y = (x+4)^2 - 4$	b. $y = (x+2)(x+6)$
a	c	24) $y = x^2 - 8x + 12$	c. $y = (x+2)^2 - 16$	c. $y = (x-2)(x-6)$
b	b	25) $y = x^2 + 8x + 12$	d. $y = (x-2)^2 - 16$	d. $y = (x-2)(x+6)$

#22) $y = x^2 - 4x - 12$
 F.F. $y = (x-6)(x+2)$
 $y = (x^2 - 4x + 4) - 12 - 4$
 V.F. $y = (x-2)^2 - 16$

#23) $y = x^2 + 4x - 12$
 F.F. $y = (x+6)(x-2)$
 $y = (x^2 + 4x + 4) - 12 - 4$
 $y = (x+2)^2 - 16$

#24) $y = x^2 - 8x + 12$
 F.F. $y = (x-6)(x-2)$
 $y = (x^2 - 8x + 16) + 12 - 16$
 $y = (x-4)^2 - 4$

#25) $y = x^2 + 8x + 12$
 $y = (x+6)(x+2)$
 $y = (x^2 + 8x + 16) + 12 - 16$
 $y = (x+4)^2 - 4$

26) Put $y = 3(x-5)(2x+1)$ into standard form.

$y = 3(2x^2 + x - 10x - 5)$
 $y = 3(2x^2 - 9x - 5)$
 $y = 6x^2 - 27x - 15$

27) Put $y = -2(x-1)^2 + 5$ into standard form.

$y = -2(x^2 - 2x + 1) + 5$
 $y = -2x^2 + 4x - 2 + 5$
 $y = -2x^2 + 4x + 3$

28) Put $y = 4x^2 + 20x + 24$ into factored form.

$$y = 4(x^2 + 5x + 6)$$

$$y = 4(x+3)(x+2)$$

29) Put $y = -6x^2 - 15x + 9$ into factored form.

$$2x - 1 = 0$$

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

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

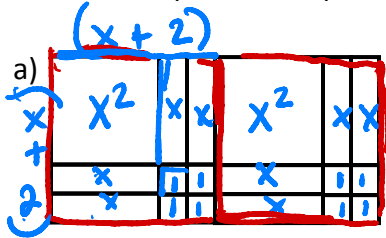
$$y = -3(2x - 1)(x + 3)$$

or

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

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

30) Write two equivalent expressions for each block.

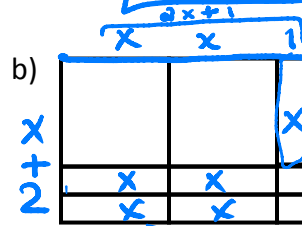


$$A = 2x^2 + 8x + 8$$

$$= 2(x^2 + 4x + 4)$$

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

Factor completely.



$$A = 2x^2 + 5x + 2$$

$$A = (2x+1)(x+2)$$

31) $x^2 - 10x + 24$

$$(x-6)(x-4)$$

32) $3x^2 - 11x + 6$

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

33) $x^2 - 36$

$$(x+6)(x-6)$$

34) $2x^2 + 8x + 6$

$$2(x^2 + 4x + 3)$$

$$2(x+3)(x+1)$$

35) $4x^2 - 64$

$$4(x^2 - 16)$$

$$4(x+4)(x-4)$$

36) $x^2 + 4x + 1$

prime

37) $x^2 + 12x - 28$

$$(x+14)(x-2)$$

38) $4x^2 + 8x - 5$

$$(2x-1)(2x+5)$$

39) $3x^2 - 14x - 5$

$$(3x+1)(x-5)$$

40) $5x^2 - 25x$

$$5x(x-5)$$

41) $14x^2 + 6x - 8$

$$2(7x^2 + 3x - 4)$$

$$2(7x-4)(x+1)$$

42) $2x^2 - x - 8$

prime

43) $x^2 + 9$

prime

44) $6x^2 + 25x + 24$

$$(3x+8)(2x+3)$$

45) $-12x^2 + 38x - 6$

$$-2(6x^2 - 19x + 3)$$

$$-2(6x-1)(x-3)$$