

1.) $x^2 - 12x + 32 = 0$

Annotations: "both have same sign" (pointing to -12 and 32), "gives sign" (pointing to -12).

Must be equal to zero in order to find the zeros
 $y = 0$ x-int

$$\frac{-4}{-4} * \frac{-8}{-8} = \boxed{32}$$

$$\frac{-4}{-4} + \frac{-8}{-8} = \boxed{-12}$$

Factors of 32

$$4 * 8$$

$$2 * 16$$

$$1 * 32$$

$$(x-4)(x-8) = 0$$

$$x-4=0$$

$$+4 \quad +4$$

$$\boxed{x=4}$$

$$x-8=0$$

$$+8 \quad +8$$

$$\boxed{x=8}$$

Average of the zeros

$$\frac{4+8}{2} = \frac{12}{2} = \textcircled{6}$$

$$x^2 - 12x + 32$$

$$a=1 \quad b=-12 \quad c=32$$

$$h = \frac{-b}{2a} = \frac{-(-12)}{2(1)} = \frac{12}{2} = \textcircled{6}$$

$$k = (6)^2 - 12(6) + 32$$

$$36 - 72 + 32$$

$$-36 + 32 = -4$$

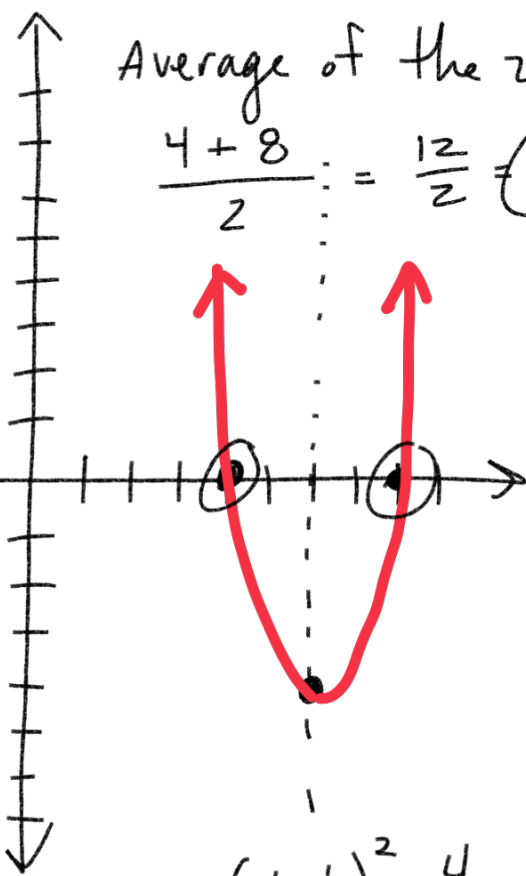
vertex:

$$(6, -4)$$

vertex form:

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

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



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

$$0 = (x-6)^2 - 4$$

$$+4 \qquad +4$$

$$\sqrt{4} = \sqrt{(x-6)^2} \quad x = 6+2 \textcircled{8}$$

$$\pm 2 = x-6 \quad 6-2 \textcircled{4}$$

$$+6 \qquad +6$$

2.) $x^2 - 6x - 16 = 0$ signs different

a) $-8 \times 2 = -16$
 $-8 + 2 = -6$

b) find zeros

a) factor

b) find zeros

c) Find vertex

d) graph

e) find vertex form

$$(x-8)(x+2) = 0$$

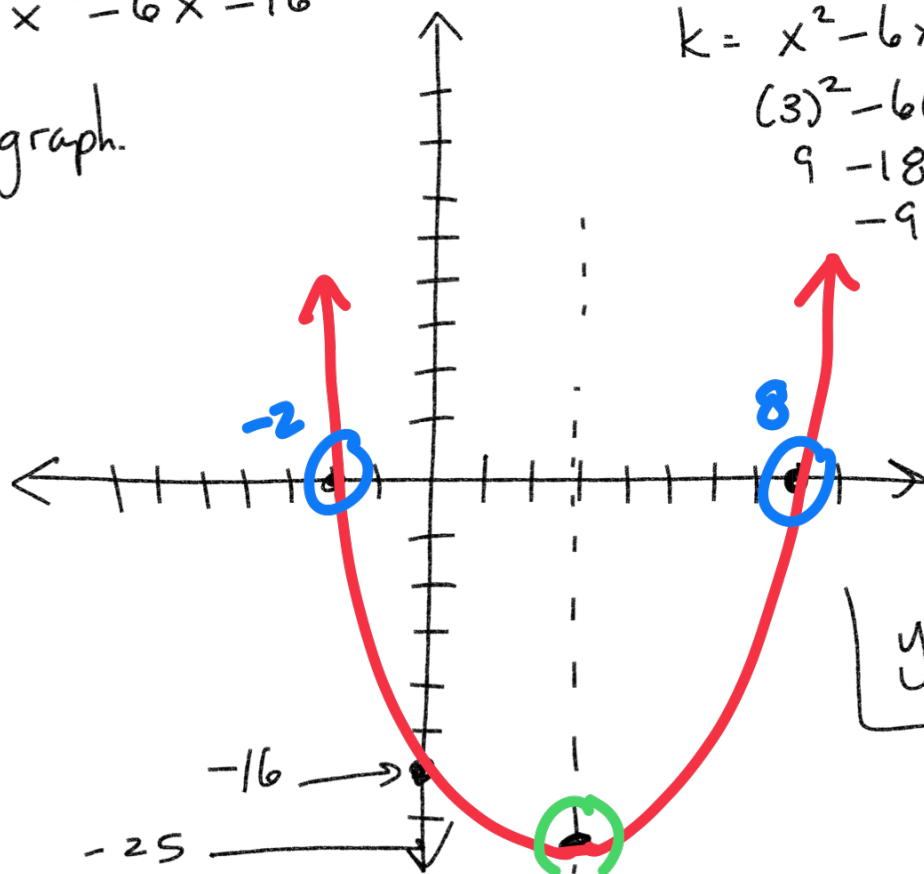
$$\begin{array}{l} \swarrow \quad \searrow \\ x-8=0 \quad x+2=0 \\ +8 \quad +8 \quad -2 \quad -2 \\ \boxed{x=8} \quad \boxed{x=-2} \end{array}$$

$$(x-8)(x+2)$$

$$x^2 + 2x - 8x - 16$$

$$x^2 - 6x - 16$$

d.) graph.



c) find vertex

Optim 1: Average of zeros

$$\frac{8 + (-2)}{2} = \frac{6}{2} = 3$$

Optim 2: $h = -\frac{b}{2a}$

$$a=1 \quad b=-6 \quad c=-16$$

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

vertex:

$$(3, -25)$$

$$k = x^2 - 6x - 16$$

$$(3)^2 - 6(3) - 16$$

$$9 - 18 - 16$$

$$-9 - 16 = -25$$

e) vertex form.

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

$$y = (x-3)^2 - 25$$

$$3.) \quad x^2 + 10x + 3 = -18 \quad \leftarrow 0?$$

$$x^2 + 10x + 21 = 0$$

$$\frac{3}{3} * \frac{7}{7} = 21$$

$$\frac{3}{3} + \frac{7}{7} = 10$$

$$(x+3)(x+7) = 0$$

$$x+3=0$$

$$-3 \quad -3$$

$$x = -3$$

$$x+7=0$$

$$-7 \quad -7$$

$$x = -7$$

vertex?

$$\frac{-3 + (-7)}{2} = \frac{-10}{2} = -5 = h$$

$$x^2 + 10x + 21 = (x+3)(x+7)$$

$$(-5, -4)$$

$$(-5+3)(-5+7)$$

$$(-2)(2) = -4$$

$$4.) \quad x^2 - 2x + 35 = 50 \quad \leftarrow 0$$

$$x^2 - 2x - 15 = 0$$

$$\frac{-5}{-5} * \frac{3}{3} = -15$$

$$\frac{-5}{-5} + \frac{3}{3} = -2$$

find zeros.

$$(x-5)(x+3) = 0$$

$$\text{Zeros: } 5, -3$$

$$5.) a) \quad \frac{2x^2}{2} + \frac{18x}{2} + \frac{40}{2} = 0$$

$$2(x^2 + 9x + 20) = 0$$

$$2(x+4)(x+5) = 0$$

$$\underline{4} * \underline{5} = 20$$

$$\underline{4} + \underline{5} = 9$$

zeros:
 $-4, -5$

$$b) \quad \frac{3x^2}{3} - \frac{30x}{3} + \frac{63}{3} = 0$$

$$3(x^2 - 10x + 21) = 0$$

$$\underline{-7} * \underline{-3} = 21$$

$$\underline{-7} + \underline{-3} = -10$$

$$3(x-7)(x-3) = 0$$

zeros: $7, 3$

perfect square
 ↓
 $x^2 - 49 = 0$

perfect square
 ↙
 $x^2 - 49 = 0$

Difference of Squares

$$x^2 - 49 = 0$$

$$+49 +49$$

$$\sqrt{x^2} = \sqrt{49}$$

$x = \pm 7$

$$x^2 - 49 = 0$$

↓

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

$$(x+7)(x-7) = 0$$

↓

↓

$-7 \quad 7$

$$x^2 - 81 = 0$$

$$(x+9)(x-9) = 0$$

$$\boxed{x = -9, 9}$$

$$\frac{2x^2}{2} - \frac{18}{2} = 0$$

$$2(x^2 - 9) = 0$$

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

$$x^2 - 81 = 0$$

$$+81 \quad +81$$

$$\sqrt{x^2} = \sqrt{81}$$

$$x = \pm 9$$

Zeros:

$$\boxed{x = -3, 3}$$

$$2x^2 - x - 45 = 0$$

$$\begin{array}{r} 2 \\ 2 \cdot 1 \\ \hline 45 \\ 1 \cdot 45 \\ \hline 5 \cdot 9 \\ 3 \cdot 15 \end{array}$$

Quadratic formula

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

$$2x + 5$$

X

-9

$$2x^2 - x - 45 = 0$$

$$a = 2 \quad b = -1 \quad c = -45$$

$$\frac{-b}{2a} = h$$

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

$$\frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-45)}}{2(2)}$$

$$\frac{1 \pm \sqrt{1 + 360}}{4}$$

$$\frac{1 \pm \sqrt{361}}{4} =$$

$$\begin{array}{l} \frac{1+19}{4} \\ \frac{20}{4} = 5 \\ \frac{1-19}{4} \\ \frac{-18}{4} = -\frac{9}{2} \end{array}$$

$$x^2 - 6x - 16 = 0$$

$$a=1 \quad b=-6 \quad c=-16$$

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

$$\frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-16)}}{2(1)}$$

$$\frac{6 \pm \sqrt{36 + 64}}{2}$$

$$\frac{6 \pm \sqrt{100}}{2}$$

$$\frac{6+10}{2} = 8$$

$$\frac{6-10}{2} = -2$$