

Identify the following characteristics when in standard form:

1.  $y = x^2 + 8x + 7$

Direction: up  
 Vertex:  $(-4, -9)$   
 AOS:  $x = -4$   
 y-int:  $(0, 7)$   
 x-int(s):  $(-1, 0) \in (-7, 0)$   
 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-8 \pm \sqrt{64 - 28}}{2} = \frac{-8 \pm \sqrt{36}}{2}$   
 $y = (-4)^2 + 8(-4) + 7 = -9$   
 $x = \frac{-8 \pm \sqrt{(8)^2 - 4(1)(7)}}{2(1)}$   
 $= \frac{-8 \pm \sqrt{36}}{2} \begin{cases} + = (-1) \\ - = (-7) \end{cases}$

2.  $y = x^2 + 8x + 6$

Direction: up  
 Vertex:  $(-4, -10)$   
 AOS:  $x = -4$   
 y-int:  $(0, 6)$   
 x-int(s):  $(-0.8338, 0) \in (-7.162, 0)$   
 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-8 \pm \sqrt{64 - 24}}{2} = \frac{-8 \pm \sqrt{40}}{2}$   
 $y = (-4)^2 + 8(-4) + 6 = -10$   
 $x = \frac{-8 \pm \sqrt{(8)^2 - 4(1)(6)}}{2(1)}$   
 $= \frac{-8 \pm \sqrt{40}}{2} \begin{cases} + = (-0.8338) \\ - = (-7.162) \end{cases}$

3.  $y = -3x^2 + 18x - 4$

Direction: down  
 Vertex:  $(3, 23)$   
 AOS:  $x = 3$   
 y-int:  $(0, -4)$   
 x-int(s):  $(0.231, 0) \in (5.769, 0)$   
 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-18 \pm \sqrt{324 - 48}}{2(-3)} = \frac{-18 \pm \sqrt{276}}{-6}$   
 $y = -3(3)^2 + 18(3) - 4 = 23$   
 $x = \frac{-18 \pm \sqrt{(18)^2 - 4(-3)(-4)}}{2(-3)}$   
 $= \frac{-18 \pm \sqrt{276}}{-6} \begin{cases} + = (0.231) \\ - = (5.769) \end{cases}$

Identify the following characteristics when in intercept form:

4.  $y = (x+7)(x+12)$

Direction: up  
 Vertex:  $(-9.5, -6.25)$   
 AOS:  $x = -9.5$   
 y-int:  $(0, 84)$   
 x-int(s):  $(-7, 0) \in (-12, 0)$   
 roots  $\begin{cases} x+7=0 & x+12=0 \\ x=-7 & x=-12 \end{cases}$   
 vertex  $\begin{cases} x = \frac{-7+(-12)}{2} = -9.5 \\ y = (-9.5+7)(-9.5+12) = -6.25 \end{cases}$   
 y-int  $y = (0+7)(0+12) = 84$

5.  $y = -2(x-5)(x-10)$

Direction: down  
 Vertex:  $(7.5, 12.5)$   
 AOS:  $x = 7.5$   
 y-int:  $(0, -100)$   
 x-int(s):  $(5, 0) \in (10, 0)$   
 roots  $\begin{cases} x-5=0 & x-10=0 \\ x=5 & x=10 \end{cases}$   
 vertex  $\begin{cases} x = \frac{5+10}{2} = 7.5 \\ y = -2(7.5-5)(7.5-10) = 12.5 \end{cases}$   
 y-int  $y = -2(0-5)(0-10) = -100$

6.  $y = 3(x+8)(x-9)$

Direction: up  
 Vertex:  $(.5, -216.75)$   
 AOS:  $x = .5$   
 y-int:  $(0, -216)$   
 x-int(s):  $(-8, 0) \in (9, 0)$   
 roots  $\begin{cases} x+8=0 & x-9=0 \\ x=-8 & x=9 \end{cases}$   
 vertex  $\begin{cases} x = \frac{-8+9}{2} = .5 \\ y = 3(.5+8)(.5-9) = -216.75 \end{cases}$   
 y-int  $y = 3(0+8)(0-9) = -216$

Identify the following characteristics when in vertex form:

7.  $y = 3(x+5)^2 - 8$

Direction: up  
 Vertex:  $(-5, -8)$   
 AOS:  $x = -5$

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

Direction: up  
 Vertex:  $(3, 1)$   
 AOS:  $x = 3$

9.  $y = -\frac{1}{2}(x-7)^2$

Direction: down  
 Vertex:  $(7, 0)$   
 AOS:  $x = 7$

**Transformations:**

10.  $y = 3(x + 2)^2 - 8$

Direction: up  
 Vertex:  $(-2, -8)$   
 AOS:  $x = -2$

Reflection? Yes/No  
 H.S.: Left 2  
 V.S.: Down 8  
 Dilation: vertical stretch/  
 (thinner)

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

Direction: down  
 Vertex:  $(4, 6)$   
 AOS:  $x = 4$

Reflection? Yes/No  
 H.S.: Right 4  
 V.S.: up 6  
 Dilation: vertical shrink  
 (wider)

12.  $y = -(x - 5)^2 - 15$

Direction: down  
 Vertex:  $(5, -15)$   
 AOS:  $x = 5$

Reflection? Yes/No  
 H.S.: Right 5  
 V.S.: Down 15  
 Dilation: n/a  
 because  $a = 1$

**Complete the Square convert the following to vertex form:**

13.  $y = x^2 + 8x + 3 = 0$   
 $\quad \quad \quad -3 \quad -3$

$x^2 + 8x + 16 = -3 + 16$

$(\frac{8}{2})^2 = (4)^2 = 16$

$(x + 4)^2 = 13$   
 $\quad \quad \quad -13 \quad -13$

$y = (x + 4)^2 - 13$

vertex:  $(-4, -13)$

AOS  $x = -4$

14.  $y = x^2 + 4x + 5 = 0$   
 $\quad \quad \quad -5 \quad -5$

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

$(\frac{4}{2})^2 = (2)^2 = 4$

$(x + 2)^2 = -1$   
 $\quad \quad \quad +1 \quad +1$

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

vertex  $(-2, 1)$

AOS  $x = -2$

15.  $y = x^2 + 18x - 7 = 0$   
 $\quad \quad \quad +7 \quad +7$

$x^2 + 18x + 81 = -7 + 81$

$(\frac{18}{2})^2 = (9)^2 = 81$

$(x + 9)^2 = 88$   
 $\quad \quad \quad -88 \quad -88$

$y = (x + 9)^2 - 88$

vertex  $(-9, -88)$

AOS  $x = -9$