

Find the vertex of the quadratic by either completing the square or using $x = -\frac{b}{2a}$. Then identify any x-intercepts and make a sketch of the graph.

1. $f(x) = -x^2 + 6x - 8$

$$x = \frac{-6}{-2} = 3$$

$$f(3) = -9 + 18 - 8 = +1$$

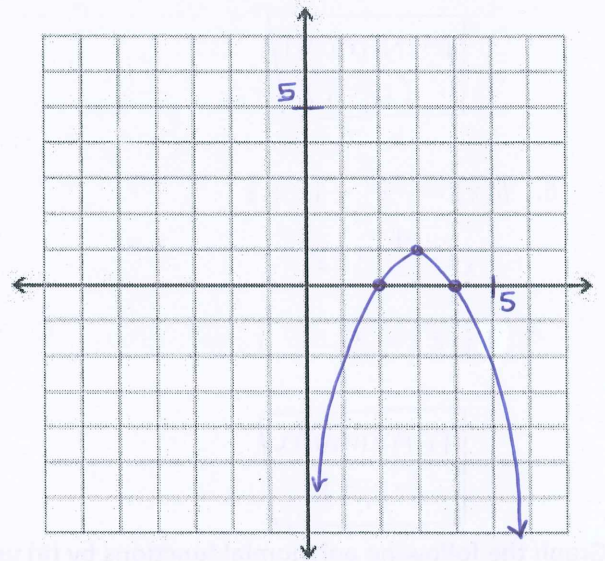
VERTEX
 $(3, 1)$

$$-x^2 + 6x - 8 = 0$$

$$x^2 - 6x + 8 = 0$$

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

X-INTERCEPTS
 $(2, 0) (4, 0)$



2. $f(x) = 2x^2 + 8x + 7$

$$x = \frac{-8}{4} = -2$$

$$f(-2) = 8 - 16 + 7 = -1$$

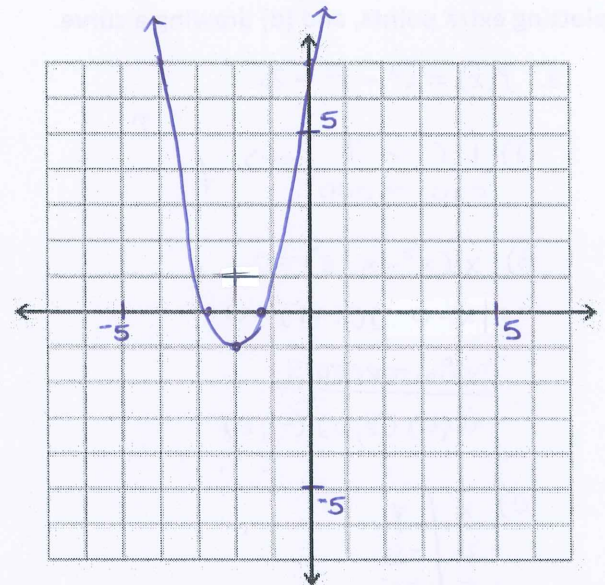
VERTEX
 $(-2, -1)$

X-INTERCEPTS
 $(\frac{-4 \pm \sqrt{2}}{2}, 0)$

$$2x^2 + 8x + 7 = 0$$

$$x = \frac{-8 \pm \sqrt{64 - 56}}{4}$$

$$= \frac{-8 \pm 2\sqrt{2}}{4}$$



3. $f(x) = -x^2 + 2x + 5$

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

$$f(1) = -1 + 2 + 5 = 6$$

VERTEX
 $(1, 6)$

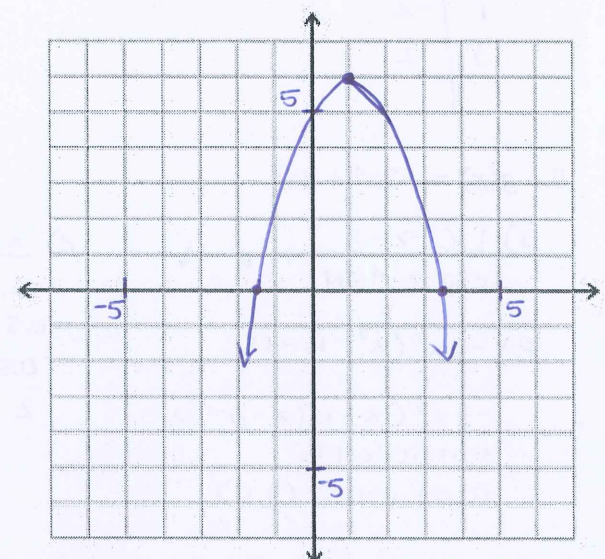
X-INTERCEPTS
 $(1 \pm \sqrt{6}, 0)$

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

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

$$x = \frac{2 \pm \sqrt{4 + 20}}{2}$$

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



Find the minimum or maximum value of the following functions.

4. $f(x) = x^2 - 7$

$x = \frac{0}{2} = 0$

$f(0) = -7$

MINIMUM
(0, -7)

5. $g(x) = x^2 + 10x + 14$

$x = \frac{-10}{2} = -5$

$g(-5) = -11$

MINIMUM
(-5, -11)

6. $h(x) = -x^2 - 4x + 1$

$x = \frac{4}{-2} = -2$

$h(-2) = 5$

MAXIMUM
(-2, 5)

7. $k(x) = -2x^2 + 16x - 31$

$x = \frac{-16}{-4} = 4$

$k(4) = 1$

MAXIMUM
(4, 1)

Graph the following polynomial functions by (a) using the Leading Coefficient Test, (b) finding x-intercepts, (c) plotting extra points, and (d) drawing a curve.

8. $f(x) = x^3 - x^2 - 2x$

a) L.C. $\rightarrow 1 \Rightarrow \uparrow$
exp. \rightarrow ODD

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

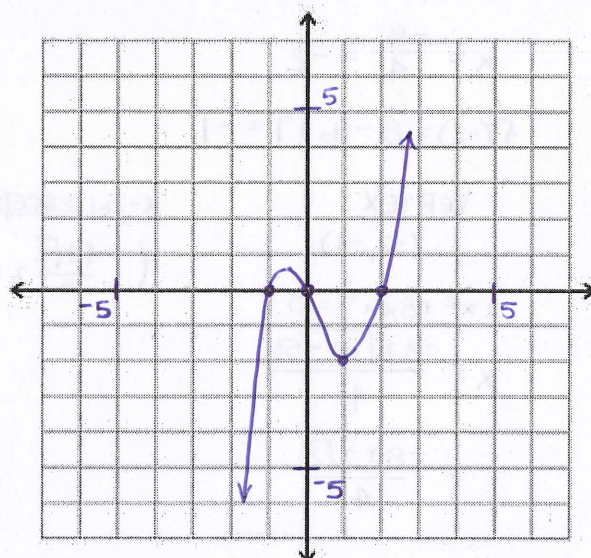
$x(x-2)(x+1) = 0$

X-INTERCEPTS

(0, 0) (2, 0) (-1, 0)

c)

x	y
-2	-8
-0.5	0.6
1	-2
3	12



9. $g(x) = -2x^4 + 2x^2$

a) L.C. $\rightarrow -2 \Rightarrow \downarrow$
exp. \rightarrow EVEN

b) $-2x^2(x^2 - 1) = 0$

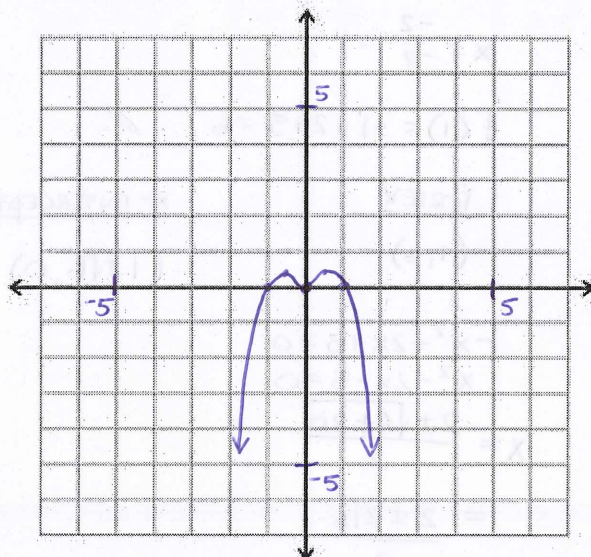
$-2x^2(x+1)(x-1) = 0$

X-INTERCEPTS

(0, 0) (-1, 0) (1, 0)

c)

x	y
-2	-24
-0.5	0.4
0.5	0.4
2	-24



10. $h(x) = -x^3 + 5x$

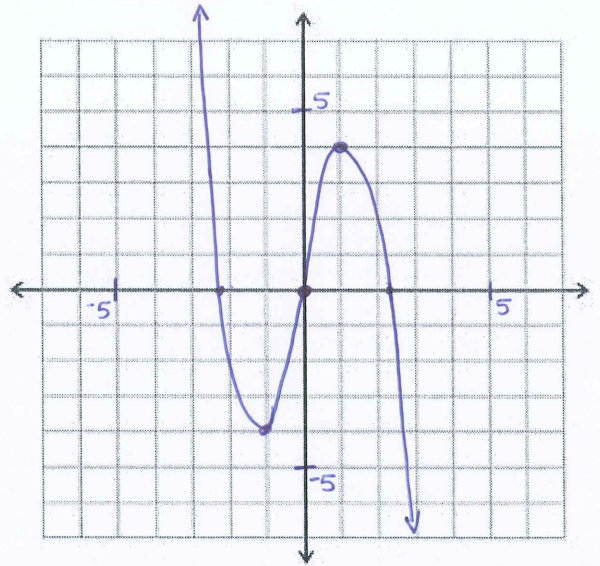
a) L.C. $\rightarrow -1 \Rightarrow \uparrow \downarrow$
Exp \rightarrow ODD

b) $-x(x^2 - 5) = 0$

X-INTERCEPTS
 $(0,0) (\pm\sqrt{5},0)$

c)

x	y
-3	12
-1	-4
1	4
3	-12



11. $f(x) = x^4 - x^3 - 20x^2$

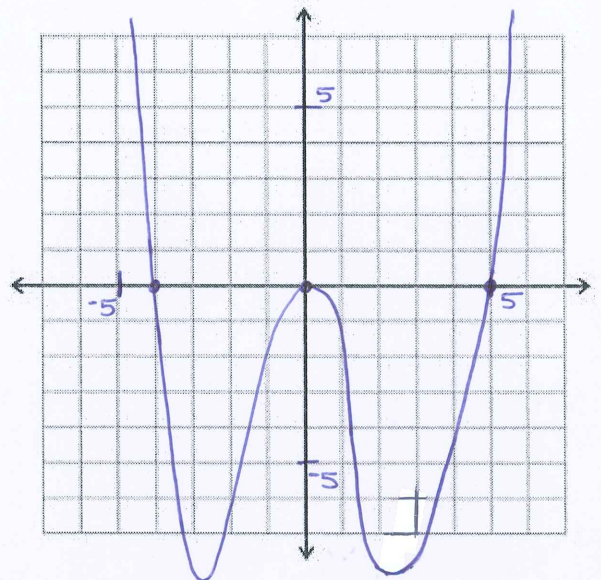
a) L.C. $\rightarrow 1 \Rightarrow \uparrow \uparrow$
Exp \rightarrow EVEN

b) $x^2(x^2 - x - 20) = 0$

X-INTERCEPTS
 $(0,0) (5,0) (-4,0)$

c)

x	y
-5	250
-3	-72
-1	-18
1	-20
4	-128
6	+360



Find a polynomial function with the given zeros, multiplicities, degrees.

12. Zero: 3, multiplicity 1; Zero: 2, multiplicity 3; Degree: 4

$$\begin{aligned}
 p(x) &= (x-3)(x-2)^3 \\
 &= (x-3)(x-2)(x-2)^2 \\
 &= (x^2 - 5x + 6)(x^2 - 4x + 4) \\
 &= x^4 - 4x^3 + 4x^2 - 5x^3 + 20x^2 - 20x + 6x^2 - 24x + 24 = \boxed{x^4 - 9x^3 + 30x^2 - 44x + 24}
 \end{aligned}$$

13. Zero: -1, multiplicity 2; Zero: -2, multiplicity 1; Degree: 3; Rises to the left, Falls to the right

$$\begin{aligned}
 p(x) &= -(x+1)^2(x+2) \\
 &= -(x+2)(x^2 + 2x + 1) \\
 &= -x^3 - 2x^2 - x - 2x^2 - 4x - 2 \\
 &= \boxed{-x^3 - 4x^2 - 5x - 2}
 \end{aligned}$$