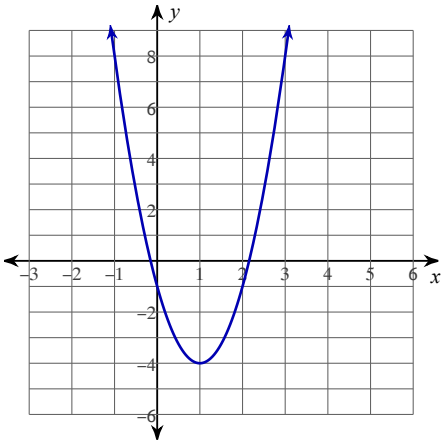
Answers to 3.1 Key Features and Basic Graphing

1) a. x-intercept(s): $(1, 0)$ & $(3, 0)$
   b. y-intercept: $(0, 3)$
   c. axis of symmetry: $x = 2$
   d. vertex: $(2, -1)$
   e. Min $y = -1$
   f. Domain: $(-\infty, \infty)$
   g. Range: $[-1, \infty)$
   h. Increasing: $(2, \infty)$
   i. Decreasing: $(-\infty, 2)$
   j. Upward Opening
   k. Positive: $(-\infty, 1)U(3, \infty)$
   l. Negative: $(1, 3)$
   m. $x \to -\infty,\ f(x) \to \infty$
   $x \to \infty,\ f(x) \to \infty$

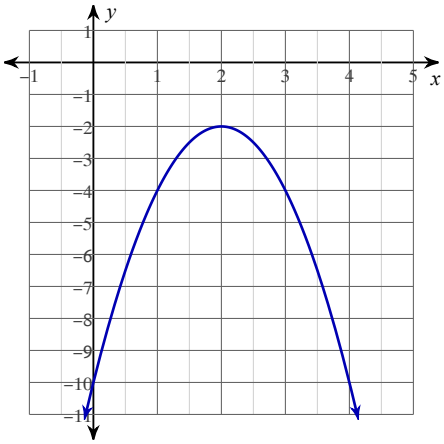
3) a. x-intercept(s): $(1, 0)$ & $(3, 0)$
   b. y-intercept: (0,not shown)
   c. axis of symmetry: $x = 5$
   d. vertex: $(5, -4)$
   e. Min $y = -4$
   f. Domain: $(-\infty, \infty)$
   g. Range: $[-1, \infty)$
   h. Increasing: $(5, \infty)$
   i. Decreasing: $(-\infty, 5)$
   j. Upward Opening
   k. Positive: $(-\infty, 3)U(7, \infty)$
   l. Negative: (-3, 7)
   m. $x \to -\infty,\ f(x) \to \infty$
   $x \to \infty,\ f(x) \to \infty$

5) 1) Identify and plot the vertex
   2) Use the growth rate (1-3-5 rule) to plot the remaining points

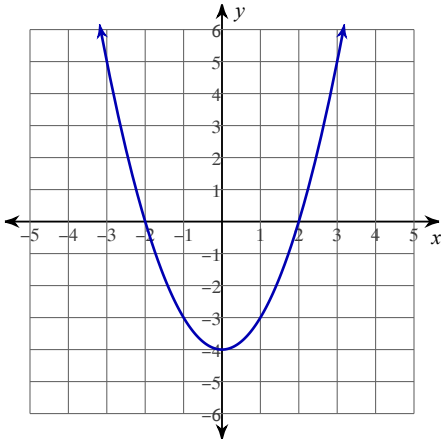
7)



9)



11)



13) a. $(-3,0)$, $(1,0)$
b. $(0,12)$
c. $x = -2$
d. $(-2,-4)$
e. -4
f. $(-\infty,\infty)$
g. $[-4,\infty)$
h. $(-2,\infty)$
i. $(-\infty,-2)$
j. Up
k. $(-\infty,-3)\text{U}(-1,\infty)$
l. $(-3,-1)$
m. $x \to -\infty,\ f(x) \to \infty$
$x \to \infty, f(x) \to \infty$