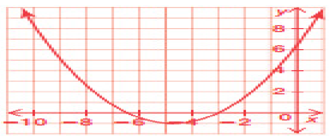
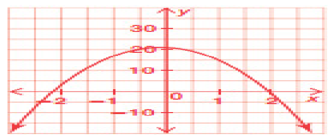
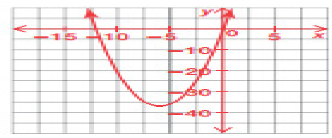
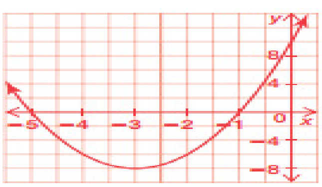
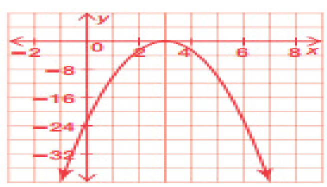
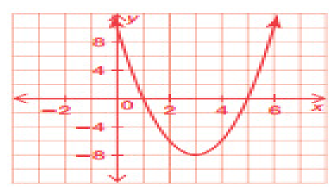
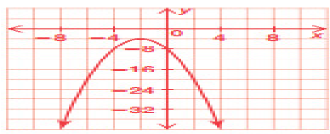
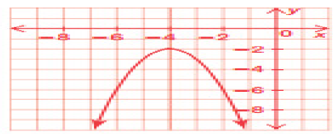
Section 4.1 (Day 3) Review of Quadratic Functions and Graphs

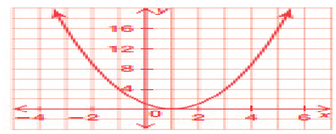
5. Analyze each table on the following three pages. Paste each function and its corresponding graph from Question 2 in the "Graphs and Their Functions" section of the appropriate table. Then, explain how you can determine each key characteristic based on the form of the given function.

Standard Form $f(x) = ax^2 + bx + c$, where $a \neq 0$		
Graphs and Their Functions		
A.  b. $f(x) = \frac{1}{3}x^2 + \pi x + 6.4$	C.  h. $f(x) = -5x^2 - x + 21$	D.  f. $f(x) = x^2 + 12x - 1$
Methods to Identify and Determine Key Characteristics		
Axis of Symmetry $x = \frac{-b}{2a}$	**x-intercept(s)** Substitute 0 for y, and then solve for x using the quadratic formula, factoring, or a graphing calculator.	**Concavity** Concave up when $a > 0$ Concave down when $a < 0$
Vertex Use $\frac{-b}{2a}$ to determine the x-coordinate of the vertex. Then substitute that value into the equation and solve for y.	**y-intercept** c-value	

Factored Form $f(x) = a(x - r_1)(x - r_2)$, where $a \neq 0$		
Graphs and Their Functions		
B.  a. $f(x) = 2(x + 1)(x + 5)$	E.  c. $f(x) = -2.5(x - 3)(x - 3)$	F.  e. $f(x) = 2(x - 1)(x - 5)$
Methods to Identify and Determine Key Characteristics		
Axis of Symmetry $x = \frac{r_1 + r_2}{2}$	**x-intercept(s)** $(r_1, 0), (r_2, 0)$	**Concavity** Concave up when $a > 0$ Concave down when $a < 0$
Vertex Use $\frac{r_1 + r_2}{2}$ to determine the x-coordinate of the vertex. Then substitute that value into the equation and solve for y.	**y-intercept** Substitute 0 for x, and then solve for y.	

<table>
<tr><th colspan="6">Vertex Form
$f(x) = a(x - h)^2 + k$, where $a \neq 0$</th></tr>
<tr><th colspan="6">Graphs and Their Functions</th></tr>
<tr>
<td colspan="2">G.


i. $f(x) = -(x + 2)^2 - 4$</td>
<td colspan="2">H.


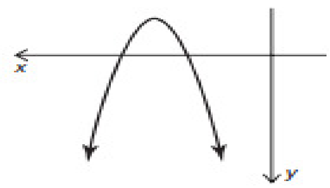
g. $f(x) = -(x + 4)^2 - 2$</td>
<td colspan="2">I.


d. $f(x) = (x - 1)^2$</td>
</tr>
<tr><th colspan="6">Methods to Identify and Determine Key Characteristics</th></tr>
<tr>
<td colspan="2">Axis of Symmetry
$x = h$</td>
<td colspan="2">x-intercept(s)
Substitute 0 for y, and then solve for x using the quadratic formula, factoring, or a graphing calculator.</td>
<td colspan="2">Concavity
Concave up when $a > 0$
Concave down when $a < 0$</td>
</tr>
<tr>
<td colspan="3">Vertex
(h, k)</td>
<td colspan="3">y-intercept
Substitute 0 for x, and then solve for y.</td>
</tr>
</table>

PROBLEM 2 What Do You Know?

1. Analyze each graph. Then, circle the function(s) which could model the graph. Describe the reasoning you used to either eliminate or choose each function.

   a.



$f_1(x) = -2(x + 1)(x + 4)$

The function f_1 is a possibility because it has a negative a-value and 2 negative x-intercepts.

$f_2(x) = -\frac{1}{3}x^2 - 3x - 6$

The function f_2 is a possibility because it has a negative a-value and a negative y-intercept.

$f_3(x) = 2(x + 1)(x + 4)$

The function f_3 can be eliminated because it has a positive a-value which means the graph would be concave up.

$f_4(x) = 2x^2 - 8.9$

The function f_4 can be eliminated because it has a positive a-value which means the graph would be concave up.

$f_5(x) = 2(x - 1)(x - 4)$

The function f_5 can be eliminated because it has a positive a-value which means the graph would be concave up.

$f_6(x) = -(x - 6)^2 + 3$

The function f_6 can be eliminated because its vertex is in Quadrant I.

Think about the information given by each function and the relative position of the graph.

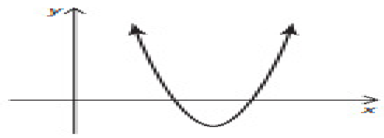
$f_7(x) = -3(x + 2)(x - 3)$

The function f_7 can be eliminated because it has one positive and one negative x-intercept.

$f_8(x) = -(x + 6)^2 + 3$

The function f_8 is a possibility because it has a negative a-value and a vertex in Quadrant II.

b.



$f_1(x) = 2(x - 75)^2 - 92$

The function f_1 is a possibility because it has a positive a-value making it concave up, and a vertex in Quadrant IV.

$f_2(x) = (x - 8)(x + 2)$

The function f_2 can be eliminated because it does not have 2 positive x-intercepts.

$f_3(x) = 8x^2 - 88x + 240$

The function f_3 is a possibility because it has a positive a-value making it concave up, and a positive y-intercept.

$f_4(x) = -3(x - 1)(x - 5)$

The function f_4 can be eliminated because it has a negative a-value which means the graph would be concave down.

$f_5(x) = -2(x - 75)^2 - 92$

The function f_5 can be eliminated because it has a negative a-value which means the graph would be concave down.

$f_6(x) = x^2 + 6x - 2$

The function f_6 can be eliminated because it has a negative y-intercept.

$f_7(x) = 2(x + 4)^2 - 2$

The function f_7 can be eliminated because it has a vertex in Quadrant III.

$f_8(x) = (x + 1)(x + 3)$

The function f_8 can be eliminated because it has 2 negative x-intercepts.

Use the given information to determine the most efficient form you could use to write the quadratic function. Write standard form, factored form, or vertex form.

7. vertex (3, 7) and point (1, 10)

vertex form

8. points (1, 0), (4, −3), and (7, 0)

factored form

9. y-intercept (0, 3) and axis of symmetry $-\frac{3}{8}$

standard form

Convert each quadratic function in factored form to standard form.

13. $f(x) = (x + 5)(x - 7)$

$f(x) = x^2 - 7x + 5x - 35$
$= x^2 - 2x - 35$

14. $f(x) = (x + 2)(x + 9)$

$f(x) = x^2 + 9x + 2x + 18$
$= x^2 + 11x + 18$

Convert each quadratic function in vertex form to standard form.

19. $f(x) = 3(x - 4)^2 + 7$

$f(x) = 3(x^2 - 8x + 16) + 7$
$= 3x^2 - 24x + 55$

20. $f(x) = -2(x + 1)^2 - 5$

$f(x) = -2(x^2 + 2x + 1) - 5$
$= -2x^2 - 4x - 7$