Name: _____

IM2 Semester 1 Final Exam Review F
(Study Guide Questions 7-9, 37-39 & 58-60)

Determining the Vertex

To determine the axis of symmetry and vertex (problems 7–9):

First, identify and plug in a, b & c in order to determine the axis of symmetry.

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

Once you have the axis of symmetry, plug that x-value into the original equation, to determine the vertex y.

Write your answer as $\boxed{x = \ ; \ (\ ,\ )}$.

1. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 - 4x + 11$.	2. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 + 12x - 10$.	3. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 - 6x - 9$.
4. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 - 2x + 4$.	5. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 - 12x + 4$.	6. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 + 8x - 3$.
7. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 - 8x + 9$.	8. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 + 4x - 7$.	9. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = x^2 - 14x + 1$.

Name: _____

To determine the vertex in factored and vertex form (problems 37–39):

For this problem, you must check each answer choice to determine if the vertex matches the given equation.
For each answer choice, start by determining its form.

If the structure has $(\quad)^2$*, then it is in vertex form.*

If the structure has $(\quad)(\quad)$*, then it is in factored form.*

Once you know the form of the answer choice, follow the steps below to identify the vertex, then compare it to the desired point.

In vertex form: $f(x) = a(x-h)^2 + k$	**In factored form:** $f(x) = a(x-r_1)(x-r_2)$
Switch the sign of h, and keep the sign of k. Write as the point (h, k)	Switch the sign of both r_1 & r_2. Plug those values into the formula for h: $h = \frac{r_1 + r_2}{2}$ Plug h (for x) into the original equation for to find y. *(That number is k).* Write as the point (h, k)

10. Which equation represents a parabola with a vertex at $(-3, 6)$? a. $f(x) = 4(x-3)^2 + 6$ b. $f(x) = -5(x+3)^2 - 6$ c. $f(x) = -6(x+2)(x+4)$ d. $f(x) = 2(x+3)(x-6)$	11. Which equation represents a parabola with a vertex at $(-1, 5)$? a. $f(x) = (x+1)(x-5)$ b. $f(x) = -3(x-1)(x+5)$ c. $f(x) = 2(x+1)^2 - 5$ d. $f(x) = 7(x+1)^2 + 5$	12. Which equation represents a parabola with a vertex at $(-2, -6)$? a. $f(x) = 3(x+2)^2 - 6$ b. $f(x) = -(x-2)^2 - 6$ c. $f(x) = 6(x-3)(x-1)$ d. $f(x) = 3(x+2)(x+6)$
13. Which equation represents a parabola with a vertex at $(-8, 4)$? a. $f(x) = 3(x+8)(x-4)$ b. $f(x) = -(x+8)(x-4)$ c. $f(x) = (x+6)(x+10)$ d. $f(x) = -4(x+7)(x+9)$	14. Which equation represents a parabola with a vertex at $(3, -7)$? a. $f(x) = -3(x-3)^2 + 7$ b. $f(x) = 7(x+3)^2 + 7$ c. $f(x) = 11(x-3)^2 - 7$ d. $f(x) = -2(x+3)^2 - 7$	15. Which equation represents a parabola with a vertex at $(9, 2)$? a. $f(x) = (x-2)(x-9)$ b. $f(x) = (x+2)(x+9)$ c. $f(x) = (x-9)^2 + 2$ d. $f(x) = (x+9)^2 - 2$
16. Which equation represents a parabola with a vertex at $(1, -4)$? a. $f(x) = (x+1)(x-3)$ b. $f(x) = -(x+1)(x-3)$ c. $f(x) = (x-1)^2 + 4$ d. $f(x) = -(x+1)^2 + 4$	17. Which equation represents a parabola with a vertex at $(8, -9)$? a. $f(x) = -(x-8)^2 + 9$ b. $f(x) = -3(x-8)^2 - 9$ c. $f(x) = 2(x+8)(x-9)$ d. $f(x) = 5(x-8)(x+9)$	18. Which equation represents a parabola with a vertex at $(-2, 6)$? a. $f(x) = -3(x-2)(x+6)$ b. $f(x) = -4(x+2)(x-6)$ c. $f(x) = -(x-2)^2 + 6$ d. $f(x) = -5(x+2)^2 + 6$

Name: _____

To determine the maximum height and landing point of a projectile (problems 58-60):

A. First, determine the maximum height, start by determining the *x*-value of the vertex.

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

Then, plug that value into the original equation to determine the *y*-value of the vertex.

This value is the maximum height.

B. Determine the two roots of the quadratic by plugging a, b & c into the quadratic formula.

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

Simplify one piece at a time.

First, each small piece: $-b = ?, b^2 = ?, -4(a)(c) = ?, 2a = ?$

Second, what's under the root: $b^2 - 4ac = ?$

Third, the root: $\sqrt{b^2 - 4ac}$

Fourth, add the top and subtract the top (there are two answers)

Fifth, divide each of your two possible numerators (fraction tops) by $2a$.

Since this rocket is a real object, it cannot land in the past, which means the positive root is the answer.

19. A rocket is launched from 336 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 64t + 336$, where t is measured in seconds and h is height above the ground measured in feet. A. Determine the maximum height obtained by the rocket. Show all work. B. Determine the time at which the rocket hits the ground. Show all work.	20. A rocket is launched from 384 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 32t + 384$, where t is measured in seconds and h is height above the ground measured in feet. A. Determine the maximum height obtained by the rocket. Show all work. B. Determine the time at which the rocket hits the ground. Show all work	21. A rocket is launched from 512 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 64t + 512$, where t is measured in seconds and h is height above the ground measured in feet. A. Determine the maximum height obtained by the rocket. Show all work. B. Determine the time at which the rocket hits the ground. Show all work

Name: _____

22. A rocket is launched from 112 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 96t + 112$, where t is measured in seconds and h is height above the ground measured in feet.

A. Determine the maximum height obtained by the rocket. Show all work.

B. Determine the time at which the rocket hits the ground. Show all work.

23. A rocket is launched from 48 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 32t + 48$, where t is measured in seconds and h is height above the ground measured in feet.

A. Determine the maximum height obtained by the rocket. Show all work.

B. Determine the time at which the rocket hits the ground. Show all work.

24. A rocket is launched from 160 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 48t + 160$, where t is measured in seconds and h is height above the ground measured in feet.

A. Determine the maximum height obtained by the rocket. Show all work.

B. Determine the time at which the rocket hits the ground. Show all work.

25. A rocket is launched from 192 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 16t + 192$, where t is measured in seconds and h is height above the ground measured in feet.

A. Determine the maximum height obtained by the rocket. Show all work.

B. Determine the time at which the rocket hits the ground. Show all work.

26. A rocket is launched from 320 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 16t + 320$, where t is measured in seconds and h is height above the ground measured in feet.

A. Determine the maximum height obtained by the rocket. Show all work.

B. Determine the time at which the rocket hits the ground. Show all work.

27. A rocket is launched from 128 ft above the ground at time $t = 0$. The function that models this situation is given by $h = -16t^2 + 112t + 128$, where t is measured in seconds and h is height above the ground measured in feet.

A. Determine the maximum height obtained by the rocket. Show all work.

B. Determine the time at which the rocket hits the ground. Show all work.

Answers

1. $x = 2; (2, 7)$			2. $x = -6; (-6, -46)$			3. $x = 3; (3, -18)$		
4. $x = 1; (1, 3)$			5. $x = 6; (6, -32)$			6. $x = -4; (-4, -19)$		
7. $x = 4; (4, -7)$			8. $x = -2; (-2, -11)$			9. $x = 7; (7, -48)$		
10. C	11. D	12. A	13. D	14. C	15. C	16. A	17. B	18. D
19. A. 400 ft B. 7 sec	20. A. 400 ft B. 6 sec	21. A. 576 ft B. 8 sec	22. A. 256 ft B. 7 sec	23. A. 64 ft B. 3 sec	24. A. 196 ft B. 5 sec	25. A. 196 ft B. 4 sec	26. A. 324 ft B. 5 sec	27. A. 324 ft B. 8 sec