Name: KEY Class: ____________ Date: ________ ID: A

Quadratic Functions Test REVIEW

Multiple Choice

Identify the choice that best completes the statement or answers the question.

A 1. Compared to the graph of $f(x) = x^2$, the graph of $g(x) = 2x^2 - 5$ is ________.

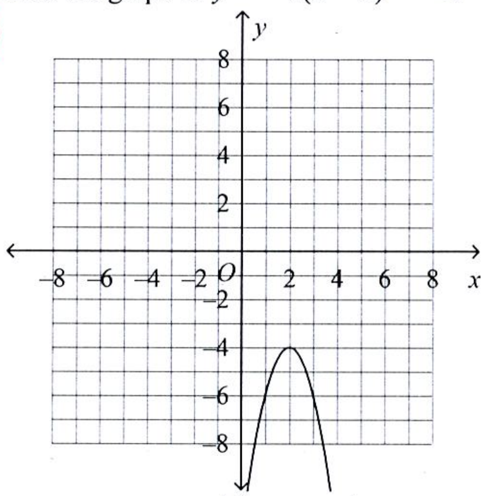
a. narrower and translated down
b. narrower and translated up
c. wider and translated down
d. wider and translated up

C 2. Which transformation from the graph of a function $f(x)$ describes the graph of $\frac{1}{3}f(x)$?

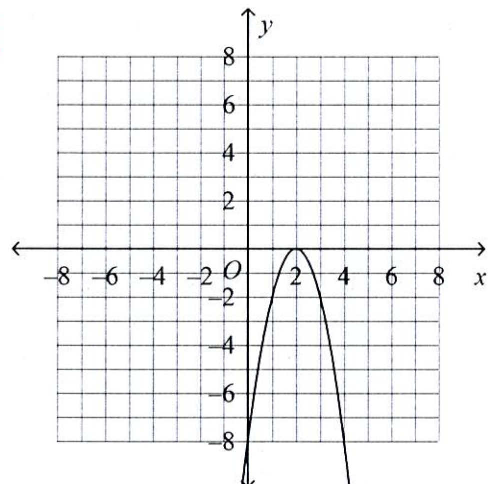
a. horizontal shift left $\frac{1}{3}$ unit
b. vertical shift up $\frac{1}{3}$ unit
c. vertical compression by a factor of $\frac{1}{3}$
d. vertical shift down $\frac{1}{3}$ unit

A 3. Which is the graph of $y = -2(x - 2)^2 - 4$?

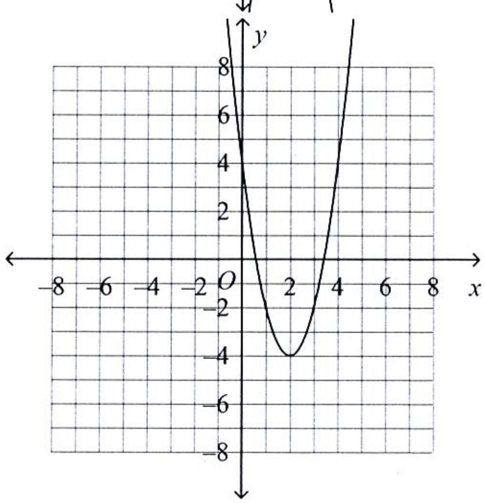
a.



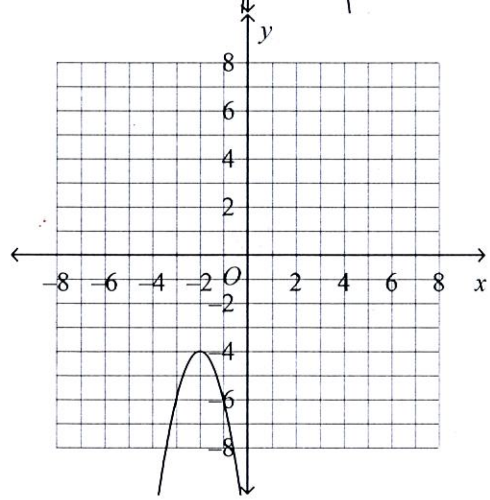
c.



b.



d.



D 4. Find the number and type of solutions for $x^2 - 9x = -8$.

a. Cannot determine without graphing.
b. The equation has one real solution.
c. The equation has two nonreal complex solutions.
d. The equation has two real solutions.

$x^2 - 9x + 8 = 0$

$(-9)^2 - 4(1)(8)$

$81 - 32$ pos.

Short Answer

1. Find the vertex and the axis of symmetry of the parabola.

$y = 3x^2 + 12x + 9$

$x = \frac{-12}{2(3)} = -2$

$y = 3(-2)^2 + 12(-2) + 9$

$12 - 24 + 9$

$\boxed{\text{AOS: } x = -2 \quad \text{vertex: } (-2, -3)}$

2. Find the coordinates of the vertex and determine whether the graph opens *up* or *down*. $y = -x^2 + x - 5$

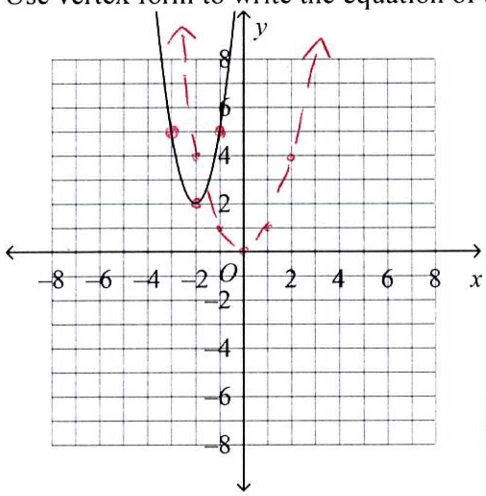
$x = \frac{-1}{2(-1)} = \frac{+1}{2}$

$-\left(\frac{1}{2}\right)^2 + \frac{1}{2} - 5$

$-\frac{1}{4} + \frac{1}{2} - 5 = -\frac{19}{4}$

$\boxed{\left(\frac{1}{2}, \frac{-19}{4}\right) \text{ opens down}}$

3. Use vertex form to write the equation of the parabola.



x | y

$\boxed{y = 3(x+2)^2 + 2}$

left 2
up 2
stretch by 3

4. Identify the vertex and the y-intercept of the graph of the function $y = -3(x + 2)^2 + 5$.

vertex $(-2, 5)$ y-int: -7

5. Complete the square for $x^2 - 14x + \square$. Then write the resulting expression as a binomial squared.

$\boxed{+49 \quad (x-7)^2}$

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Rewrite the equation in vertex form.

6. $y = x^2 + 10x + 16$

$y = (x^2 + 10x + 25) + 16 - 25$ $\boxed{y = (x+5)^2 - 9}$

7. $y = 2x^2 + 12x + 14$

$y = 2(x^2 + 6x + 9) + 14 - 18$ $\boxed{y = 2(x+3)^2 - 4}$

8. Use this description to write the quadratic function in vertex form:
The parent function $f(x) = x^2$ is vertically stretched by a factor of 2 and translated 14 units right and 6 units up.

$\boxed{y = 2(x-14)^2 + 6}$

Factor the expression.

9. $-15x^2 - 21x$ $\boxed{-3x(5x+7)}$

10. $8x^2 + 12x - 16$ $4(x^2 + 3x - 4) = \boxed{4(x+4)(x-1)}$

11. $x^2 - 2x - 63$ $\boxed{(x-9)(x+7)}$

12. $3x^2 + 26x + 35$ $\boxed{(x+7)(3x+5)}$

13. $9x^2 - 16$ $\boxed{(3x+4)(3x-4)}$

Solve the equation.

14. $x^2 + 18x + 81 = 25$

$-25 \quad -25$

$x^2 + 18x + 56 = 0$

$(x+14)(x+4) = 0$

$\boxed{x = -14}$ $\boxed{x = -4}$

15. Find the zeros of the function $h(x) = x^2 + 23x + 60$ by factoring.

$x^2 + 23x + 60 = 0$

$(x+20)(x+3) = 0$

$\boxed{x = -20}$ $\boxed{x = -3}$

16. Find the roots of the equation $30x - 45 = 5x^2$ by factoring.

$-30x \quad +45$

$5x^2 - 30x + 45 = 0$

$5(x^2 - 6x + 9) = 0$

$5(x-3)(x-3) = 0$

$\boxed{x = 3}$

17. Solve the equation.
$25x^2 - 9 = 0$

$+9 \quad +9$

$\frac{25x^2}{25} = \frac{9}{25}$

$\sqrt{x^2} = \sqrt{\frac{9}{25}}$

$\boxed{x = \pm\frac{3}{5}}$

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18. Solve the equation. Round the solution(s) to the nearest hundredth.

$7x^2 - 4 = 100$

$+4 \quad +4$

$7x^2 = 104$

$x^2 = 14.857$

$\boxed{x = \pm 3.85}$

Use the Quadratic Formula to solve the equation.

19. $5x^2 + 9x - 2 = 0$

$x = \dfrac{-9 \pm \sqrt{(9)^2 - 4(5)(-2)}}{2(5)}$ $\quad x = \dfrac{-9 \pm \sqrt{121}}{10}$ 11

$\boxed{x = 1/5 ; -2}$

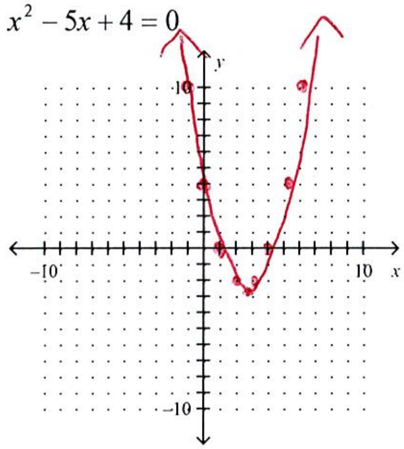
20. Find the zeros of $f(x) = x^2 + 7x + 9$ by using the Quadratic Formula.

$x = \dfrac{-7 \pm \sqrt{(7)^2 - 4(1)(9)}}{2(1)}$ $\quad x = \dfrac{-7 \pm \sqrt{13}}{2}$ $\quad \boxed{x = -1.70, -5.30}$

Solve By Graphing

21. Solve the equation by graphing.

$x^2 - 5x + 4 = 0$

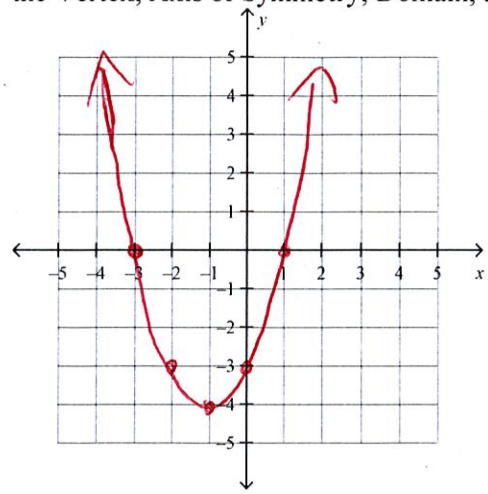


$x = \dfrac{5}{2(1)} = \dfrac{5}{2}$

x	y
-1	10
0	4
1	0
2	-2
3	-2
4	0
5	4

$\boxed{\text{zeros: } x = 1, 4}$

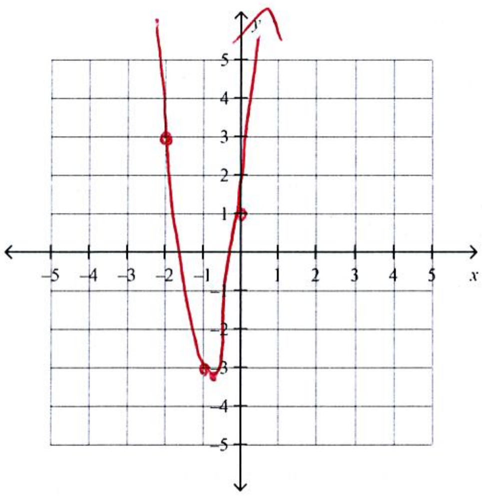
22. State the solutions and the vertex of the graph of $y = x^2 + 2x - 3$. Then sketch the graph of the function. State the Vertex, Axis of Symmetry, Domain, and Range of the function.



x	y
-3	0
-2	-3
-1	-4
0	-3
1	0

Vertex $(-1,-4)$
AOS: $x=-1$
Domain: $\mathbb{R}$
Range: $y \geq -4$

23. Create a table for the quadratic function $f(x) = 5x^2 + 9x + 1$, and use it to graph the function. State whether the vertex is a minimum or a maximum.



$x = \frac{-9}{5(2)} = \frac{-9}{10}$

$y = 5(\frac{-9}{10})^2 + 9(\frac{-9}{10}) + 1$

-3.05

x	y
-2	3
-1	-3
-9/10	-3.05
0	1

vertex $(-.9, -3.05)$

Minimum

Quadratic Application Problems

24. A gardener wants to create a rectangular vegetable garden in a backyard. She wants it to have a total area of 120 square feet, and it should be 12 feet longer than it is wide. What dimensions should she use for the vegetable garden? Round to the nearest hundredth of a foot.

$x(x+12) = 120$

$x^2 + 12x - 120 = 0$

$x = \frac{-12 \pm \sqrt{(12)^2 - 4(1)(-120)}}{2(1)}$

$x = 6.49, -18.49$

6.5×18.5

25. A pigeon lands on top of the Eiffel Tower and then, spotting a scrap of food, dives to the ground below. The pigeon's height in meters is approximately $h(t) = -5t^2 + 300$ where t is the time in seconds. About how long is the pigeon in the air?

$-5t^2 + 300 = 0$
$-300 \quad -300$
$-5t^2 = -300$
$\frac{-5t^2}{-5} = \frac{-300}{-5}$
$t^2 = 60$

$t = \pm 7.75$

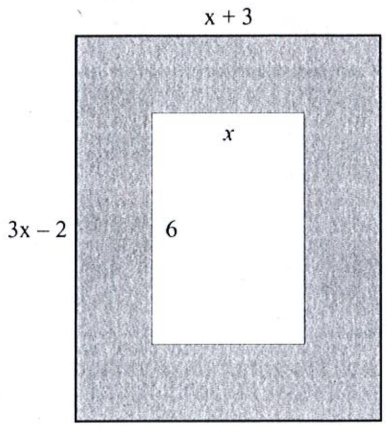
7.75 sec

26. The height of an arrow that is shot upward at an initial velocity of 40 meters per second can be modeled by $h = 40t - 5t^2$, where h is the height in meters and t is the time in seconds. Find the time it takes for the arrow to reach the ground.

$-5t^2+40t=0 \quad t=0 \quad t=8$

$-5t(t-8)=0$ $\boxed{8\text{ sec}}$

27. Write a polynomial to represent the area of the shaded region. Then solve for x given that the area of the shaded region is 24 square units.



large small

$(x+3)(3x-2) - x(6)$

$3x^2-2x+9x-6 \; -6x$

$3x^2+x-6=24$

$-24 \quad -24$

$3x^2+x-30=0$

$(x-3)(3x+10)=0$

$\boxed{x=3}$ $\boxed{\cancel{x=\frac{-10}{3}}}$

$x = \frac{-1 \pm \sqrt{(1)^2-4(3)(-30)}}{2(3)}$ ← 361

$\frac{-1 \pm \sqrt{361}}{6}$

$x=3 \quad x=-3.33$

28. The equation $h = -16t^2 + 47t + 3$ gives the height h, in feet, of a football as a function of time t, in seconds, after it is kicked. What is the maximum height the football reaches?

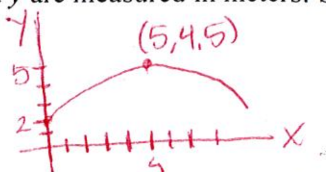
$x = \frac{-47}{2(-16)} = 1.47 \quad h = -16(1.47)^2 + 47(1.47) + 3$

$\boxed{37.52\text{ ft}}$

29. You toss a ball that travels on the path $y = -0.1x^2 + x + 2$ where x and y are measured in meters. Sketch the path of the ball. What is the maximum height of the ball?

$x = \frac{-1}{2(-.1)} = 5 \quad y = -.1(5)^2 + 5 + 2$

$\boxed{4.5\text{ m}}$



30. During a halftime show, a baton twirler releases her baton from a point 4 feet above the ground with an initial vertical velocity of 25 feet per second.

$h = -16t^2 + vt + c$

Part A: Use the vertical motion model to write a function for the height h (in feet) of the baton after t seconds.

$h = -16t^2 + 25t + 4$

Part B: Graph the function in ***Part A***. Label the vertex of the graph.

Part C: How high does the baton go? Round your answer to the nearest tenth. $\boxed{13.77\text{ ft}}$

Part D: How long after the baton is released does it reach its maximum height? $\boxed{.78\text{ sec}}$

Part E: At what moments is the baton at a height of 10 feet? Round your answer to the nearest hundredth.

$10 = -16t^2 + 25t + 4 \quad 0 = -16t^2 + 25t - 6$ $\boxed{x = .29\text{ sec}, 1.27\text{ sec}}$

(E) $x = \frac{-25 \pm \sqrt{(25)^2 - 4(-16)(-6)}}{2(-16)}$ ← 241

Part F: How much time does the twirler have if she plans to catch the baton on its way down at a height of 5 feet? Round your answer to the nearest hundredth.

$5 = -16t^2 + 25t + 4$

$x = .04$

$0 = -16t^2 + 25t - 1$

$\boxed{x = 1.52\text{ sec}}$

$x = \frac{-25 \pm \sqrt{(25)^2 - 4(-16)(-1)}}{2(-16)}$ ← 561