

Quiz: Functions and Quadratics

Take home, open notes, open book (including Wikipedia and other online materials). No online calculators or human help. Due Tuesday.

Answer this section's problems on lined paper using IB standards. (and no ragged edges)

Solve for the roots or zeros of a quadratic function, $f(x) = 0$

Factoring

Factor each function then state the function's zeros.

1. $f(x) = x^2 - 5x$
2. $f(x) = x^2 + 5x + 6$
3. $f(x) = 2x^2 - 15x + 7$
4. $f(x) = \frac{1}{2}x^2 + 4x - 10$

Using the quadratic formula

Find an exact solution by using the quadratic formula:

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

5. $x^2 + 3x - 5 = 0$
6. $3x^2 + 7x = 2$

Use the discriminant in the following two problems. $D = b^2 - 4ac$

7. Show that the function $f(x) = -2x^2 - 6x + 5$ has two distinct zeros.
8. Solve for k such that the function $g(x) = x^2 - kx + 25$ has a single (double) root.

Completing the square

Rewrite the function in vertex form: $f(x) = a(x - h)^2 + k$. Include the step showing the $(-\frac{b}{2a})^2$ term. State the vertex as an ordered pair and the equation for the axis of symmetry.

9. $f(x) = x^2 + 6x + 4$
10. $f(x) = x^2 - 12x + 20$

The inverse of a function

Derive the inverse of each function. Simplify the expression.

11. $f(x) = 2x + 1$
12. $f(x) = \sqrt{x + 2}$

Function substitution

13. Given $f(x) = 3x^2 - x + 17$. Simplify $f(-3x)$.
14. Given $f(x) = 5 - (x^2 + 4x)$. Simplify $f(\frac{1}{3}x + 1)$.

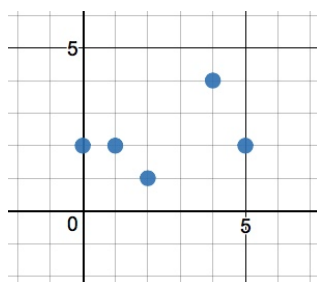
Function composition

In each exercise, perform the composition $f \circ g$ and simplify.

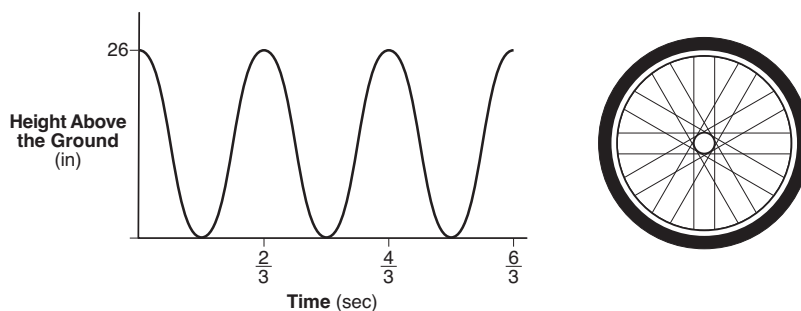
15. Given $f(x) = x^2 - x$ and $g(x) = 3x - 1$
16. Given $f(x) = 1 - \frac{2x}{x^2 - x}$ and $g(x) = 2x$

Domain and range of a function

17. Write down the domain and range of the function graphed below.



18. What is the range of the given function modeling a bicycle wheel?



Function transformations

Describe how the functions below have transformed from the parent function $f(x) = |x|$.

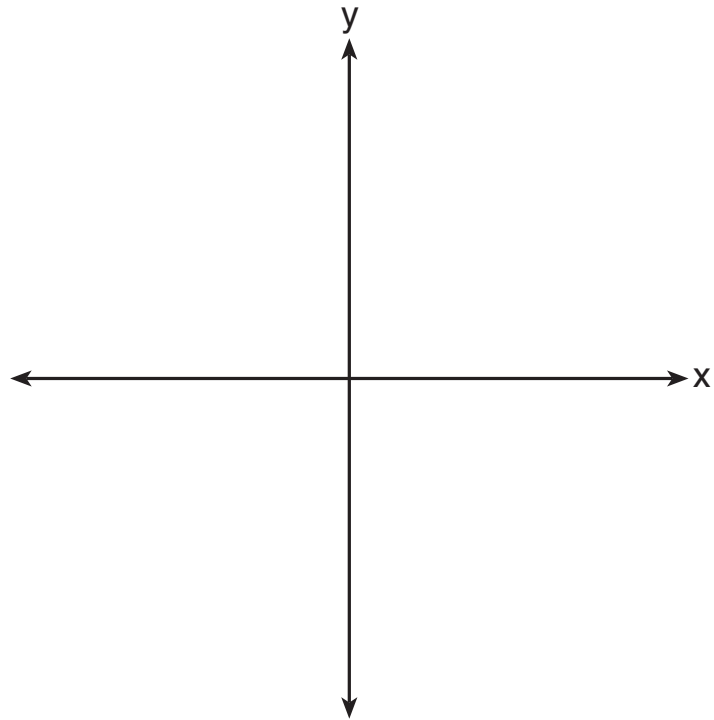
19. $g(x) = |x + 2|$
20. $h(x) = -|x| + 2$

Sketching a quadratic function

Answer in the space provided. (you may also use additional lined paper)

21. Given $f(x) = -(x - 3)^2 + 16$

- (a) Write down the vertex of the function as an ordered pair.
- (b) Write down the equation of the axis of symmetry.
- (c) Expand the function from vertex form to standard form, $ax^2 + bx + c$ where $a, b, c \in \mathbb{R}$.
- (d) Write down the value of $f(0)$. Explain what this represents on the graph.
- (e) Hence factor the function. Write down the roots.
- (f) Sketch the function, labeling the intercepts with values and the vertex as an ordered pair. Show the axis of symmetry as a dotted line and label it with its equation.



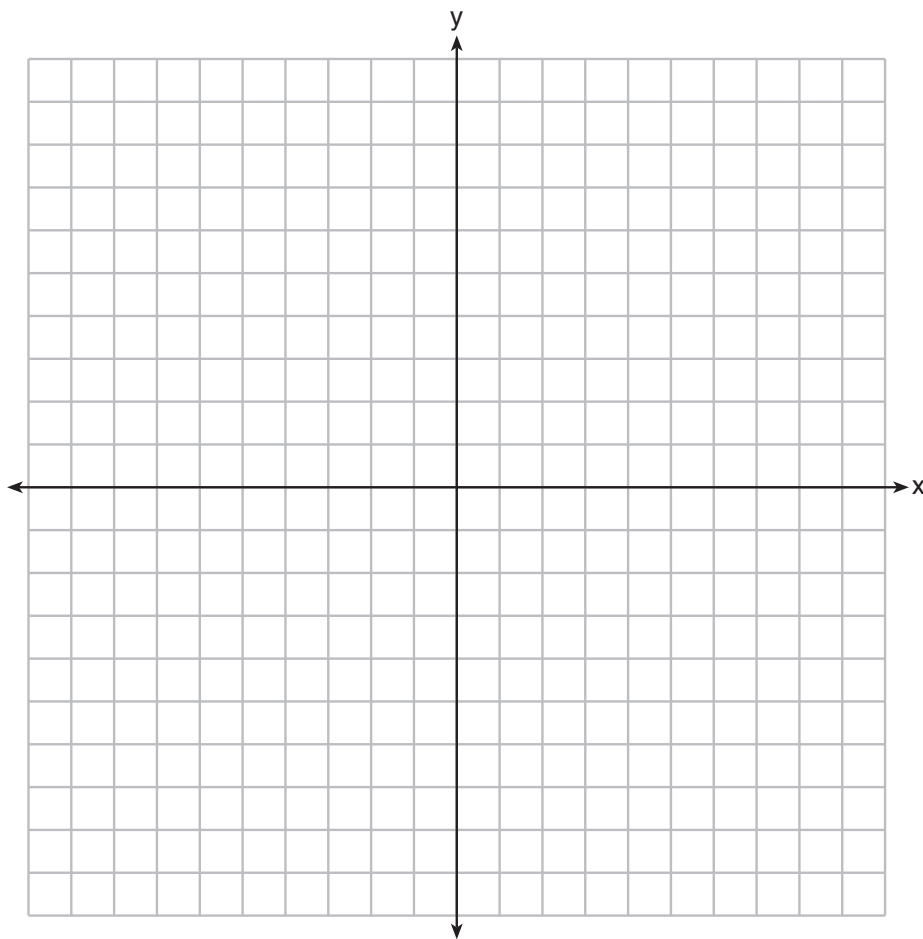
- (g) Write down the domain and range of the function.

Graphing quadratics

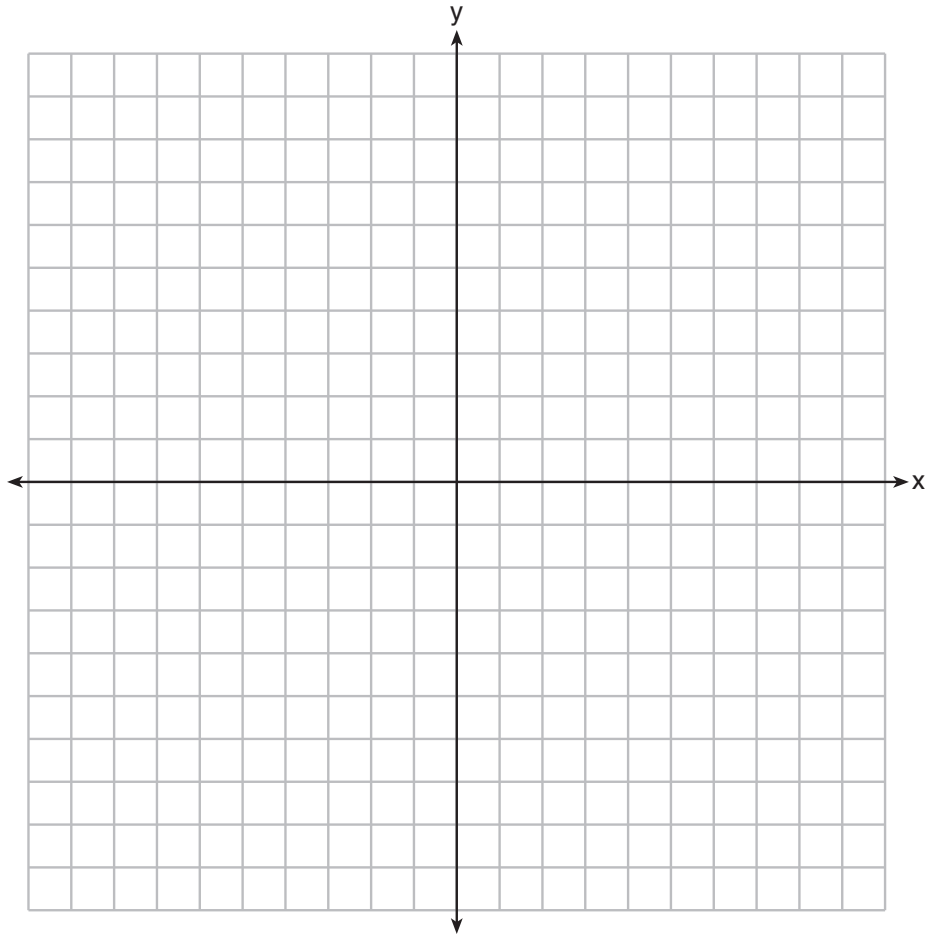
Answer on lined paper. Graph the function on the grid shown below.

22. Given the function $f(x) = -x^2 - x + 6$.

- (a) Write down the y -intercept.
- (b) State whether the parabola opens upward or downward. Explain how you know this from the function expressed in standard form.
- (c) Express the function in factored form. Hence state the solutions to $f(x) = 0$.
- (d) Show that the axis of symmetry of the parabola is $x = -\frac{1}{2}$.
- (e) Hence state the vertex as an ordered pair.
- (f) Graph the function. Mark the vertex as an ordered pair and label each intercept with its value. Plot the axis of symmetry as a dotted line and label it with its equation.
- (g) Write down the domain and range of the function.



23. (a) Graph the parent function $f(x) = x^2$. Mark the point $P(3, f(3))$ on the graph
(b) The function $g(x)$ is the function f after being translated to the right 5 and down 4. Graph g .
(c) Mark the point on the function g , Q , that represents the point P after the translation.



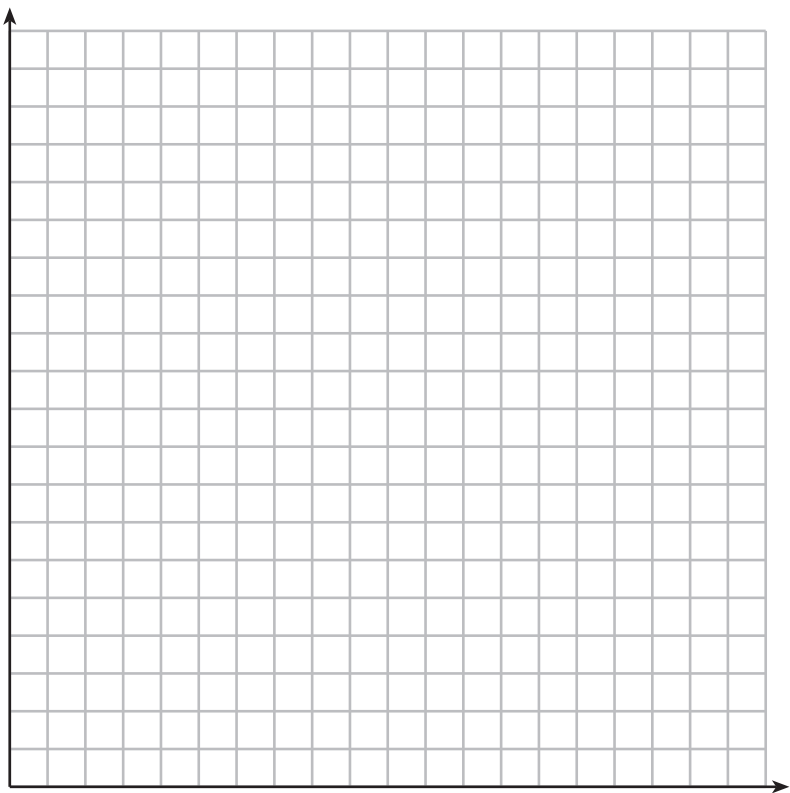
Model situations with quadratic functions

24. The path of a diver is given by

$$f(x) = -5x^2 + 12x + 9$$

where y is the height (in meters) and x is time in seconds.

- (a) On the grid below, graph the function over the domain where $x \geq 0$ and the range where $f(x) \geq 0$. Use a horizontal scale of 5 squares equals one second and vertical scale of 1 square equals one meter. Label the intercepts and vertex.
- (b) What is the maximum height of the diver? Label the point on the graph with the word “max.”
- (c) What is the time when the diver enters the water? Label the point on the graph representing this with the word “splash.”



Honor pledge

I have not received human help with this test, nor have I used calculators (including Desmos) except for an approved graphing calculator. Signed: