

Functions and Transformations: math practice, Grade 11 – download the PDF

22 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Evaluating a function

★ ★ ★

Let $f(x) = 3x^2 - 2x + 5$. Compute $f(-2)$, $f(0)$ and $f(3)$.

2 Is it a function?

★ ★ ★

Consider the two relations $A = \{(-3, 4), (-1, 2), (0, 2), (2, -5), (4, 1)\}$ and $B = \{(1, 3), (2, 5), (1, -3)\}$.

- Which one is a function? Justify.
- For the function, give the domain and the range.

3 Finding domains

★ ★ ★

Find the domain of each function.

a. $f(x) = \sqrt{x - 4}$

b. $g(x) = \frac{5}{x + 3}$

c. $h(x) = \sqrt{3x + 12}$

4 Name the shift



Name the parent function and describe the transformation for each graph.

a. $g(x) = (x + 4)^2 - 7$

b. $h(x) = -|x| + 2$

c. $k(x) = \sqrt{x - 5}$

5 Sum, difference, product



Let $f(x) = 2x + 3$ and $g(x) = x - 6$. Find $(f + g)(x)$, $(f - g)(x)$, $(fg)(x)$, then compute $(f + g)(4)$.

6 First composition



Let $f(x) = x + 5$ and $g(x) = 2x$.

a. Compute $f(g(3))$ and $g(f(3))$.

b. Find $f(g(x))$ and $g(f(x))$. Are they equal?

7 A first inverse



Find the inverse of $f(x) = 4x - 7$, then check your answer with the value $f^{-1}(5)$.

8 Piecewise evaluation



A function is defined by

$$f(x) = \begin{cases} x + 4 & \text{if } x < -1 \\ x^2 & \text{if } -1 \leq x \leq 2 \\ 6 - x & \text{if } x > 2 \end{cases}$$

Compute $f(-3)$, $f(-1)$, $f(0)$, $f(2)$ and $f(5)$.

9 Build the equation



The graph of $y = x^2$ is reflected over the x-axis, shifted 3 units right, then 5 units up.

- Write the equation of the new function g .
- Give its vertex and compute $g(1)$.

10 Taxi fare



A taxi charges a base fee of \$3 plus \$2.50 per mile. The fare for a ride of m miles is $C(m) = 3 + 2.5m$.

- Give the domain and the range of C in this context.
- Find $C(12)$.
- Find the length of a ride that costs \$48.
- Find the inverse function and explain what it computes.

11 Composition with a quadratic



Let $f(x) = x^2 - 3$ and $g(x) = 2x + 1$. Find $f(g(x))$ and $g(f(x))$, then compute $f(g(2))$ and $g(f(2))$.

12 A quotient with a hole



Let $f(x) = x^2 - 9$ and $g(x) = x - 3$.

- Simplify $\left(\frac{f}{g}\right)(x)$ and give its domain.
- Give the domain of $\left(\frac{g}{f}\right)(x)$.

13 Inverse of a rational function



Find the inverse of $f(x) = \frac{3}{x-1} + 2$ and verify it using the value $f(4)$.

14 Absolute value equation and inequality



Solve.

a. $|2x - 5| = 9$

b. $|x - 3| < 4$ (describe the answer on a number line and in interval notation).

15 Domain and range from a transformation

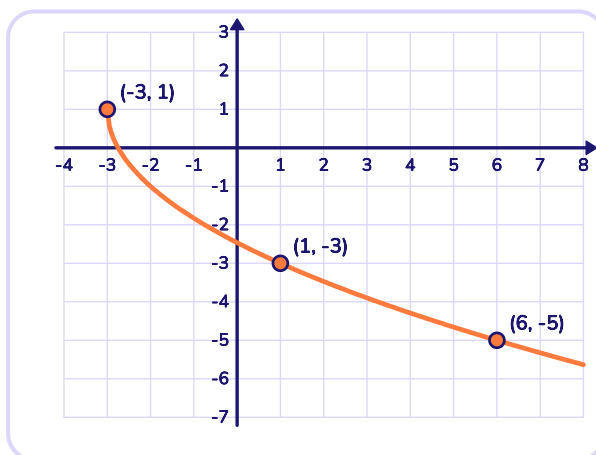


Let $g(x) = -2\sqrt{x+3} + 1$.

a. Give the domain and range of g .

b. Compute $g(1)$ and solve $g(x) = -5$.

c. Describe the transformation of $\sqrt{x}$ and compare with the graph.



16 Inverse with a restricted domain



Let $f(x) = (x - 3)^2 + 1$ with the domain restricted to $x \geq 3$.

- Explain why the restriction is needed.
- Find $f^{-1}(x)$, with its domain and range.
- Check with $f(5)$.

17 Does the order matter?



Let $f(x) = \sqrt{x}$ and $g(x) = x - 4$.

- Find $f(g(x))$ and $g(f(x))$.
- Find the domain of each composition.
- Are the two compositions equal? Justify with a value of x .

18 Parking fees



A garage charges \$4 for the first 2 hours. After that it adds \$3 for each additional hour (prorated), and the total is capped at \$25. With t in hours,

$$P(t) = \begin{cases} 4 & \text{if } 0 < t \leq 2 \\ 4 + 3(t - 2) & \text{if } 2 < t \leq 9 \\ 25 & \text{if } t > 9 \end{cases}$$

- Compute $P(1.5)$, $P(5)$ and $P(12)$.
- For which time is the fee \$19?
- Explain why the cap starts at 9 hours, and sketch the graph.

19 Absolute value as a piecewise function



Let $h(x) = 2|x - 1| - 3$.

- Write h as a piecewise function without absolute values.
- Find the zeros of h .
- Give the vertex and the range.

20 Discount or coupon first?



A store offers a 20% discount, and you also have a \$5 coupon. Let $f(x) = 0.8x$ (the discount) and $g(x) = x - 5$ (the coupon), where x is the original price in dollars.

- For a \$60 jacket, compute $g(f(60))$ and $f(g(60))$.
- Find $g(f(x))$ and $f(g(x))$. Which order is cheaper, and by how much?

21 Transforming a table of values



The function f has these values:

x	-2	0	1	4
$f(x)$	1	3	-2	0

- Give four points of the graph of $g(x) = 2f(x + 1) - 3$.
- Give four points of $h(x) = f(2x)$.

22 Proving two functions are inverses



Let $f(x) = \frac{2x + 1}{x - 3}$ and $g(x) = \frac{3x + 1}{x - 2}$. Show that $f(g(x)) = x$. What does this tell you, and what would you check to be fully sure?



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