

$x$	-4	-3	-2	-1	0	1	2	3	4	8	9
$f(x)$	0	1	3	-5	-1	7	-3	5	2	-2	-6

Selected values of the continuous function  $f(x)$  are shown in the table above. Use the values in the table to answer the following.

1. Let  $g(x) = 3f(x + 2) - 1$ .

(a) Find  $g(1)$ .

(b) Find  $g(-2)$ .

(c) If  $g(k) = -7$ , find  $k$ .

2. Let  $h(x) = 5 - f(2x)$ .

(a) Find  $h(2)$ .

(b) Find  $h(0)$ .

(c) Find  $h^{-1}(4)$ .

3. Let  $p(x)$  be the function that results from applying three transformations to the graph of  $f$  in this order: a horizontal dilation by a factor of 3, a reflection over the  $x$  axis, and a vertical translation by  $-4$  units.

(a) Find  $p(3)$ .

(b) Find  $p(-6)$ .

(c) If  $p(x) = f(x)$ , find  $x$ .

4. Let  $m(x) = af(bx) + c$ , where  $a$ ,  $b$ , and  $c$  are positive constants. The graph of  $m$  can be constructed by applying three transformations to the graph of  $f$  in this order: a horizontal dilation by a factor of  $\frac{1}{2}$ , a vertical dilation by a factor of  $\frac{1}{2}$ , and a vertical translation by 3 units.

(a) Find  $m(-2)$ .

(b) Find  $m(4)$ .

(c) If  $m(k) = 0$ , find  $k$ .

$x$	-3	-1	0	1	3	4	6	9
$g(x)$	-4	2	3	6	1	-1	-5	-2

Selected values of the continuous function  $g(x)$  are shown in the table above. Use the values in the table to answer the following.

5. Let  $h(x) = -2g(x - 3) - 5$ .

(a) Find  $h(0)$ .

(b) Find  $h(3)$ .

(c) If  $h(k) = 5$ , find  $k$ .

6. Let  $n(x) = 2 + g\left(\frac{x}{3}\right)$ .

(a) Find  $n(3)$ .

(b) Find  $n(-3)$ .

(c) Find  $n^{-1}(4)$ .

7. Let  $p(x)$  be the function that results from applying three transformations to the graph of  $g$  in this order: a horizontal dilation by a factor of  $\frac{1}{2}$ , a reflection over the  $y$  axis, and a vertical translation by 1 unit.

(a) Find  $p(-2)$ .

(b) Find the average rate of change of  $p$  over the interval  $\left[-\frac{1}{2}, \frac{1}{2}\right]$ .

8. Let  $s(x) = ag(bx) + c$ , where  $a$ ,  $b$ , and  $c$  are positive constants. The graph of  $s$  can be constructed by applying three transformations to the graph of  $g$  in this order: a horizontal dilation by a factor of 3, a vertical dilation by a factor of 4, and a vertical translation by  $-5$  units.

(a) Find  $s(3)$ .

(b) Find  $s(-9)$ .

(c) If  $s(k) = -9$ , find  $k$ .

$x$	-5	-2	-1	2	3	4	6	12	15
$h(x)$	6	1	0	-3	-2	2	8	11	9

Selected values of the continuous function  $h(x)$  are shown in the table above. Use the values in the table to answer the following.

9. Let  $h(x) = 6f(x + 2) - 3$ .

(a) Find  $f(4)$ .

(b) Find  $f(0)$ .

(c) If  $f(k) = 2$ , find  $k$ .

10. Let  $h(x) = -2g\left(\frac{x}{2}\right)$ .

(a) Find  $g(6)$ .

(b) If  $g(x) = 1$ , find  $x$ .

(c) Put the following in order from least to greatest:  $g(-1)$ ,  $g(1)$ ,  $g(2)$ .

11. Let  $h(x)$  be the function that results from applying three transformations to the graph of  $j$  in this order: a horizontal dilation by a factor of  $\frac{1}{3}$ , a vertical dilation by a factor of 2, and a vertical translation by  $-4$  units.

(a) Find  $j(6)$ .

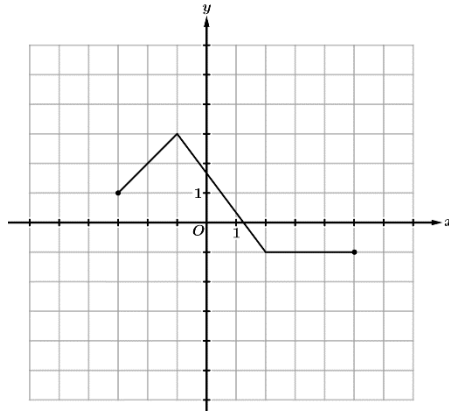
(b) Find  $j(-3)$ .

12. Let  $w(x) = 2h(x - 3) + 1$

(a) Find  $w(-2) \cdot h(6)$ .

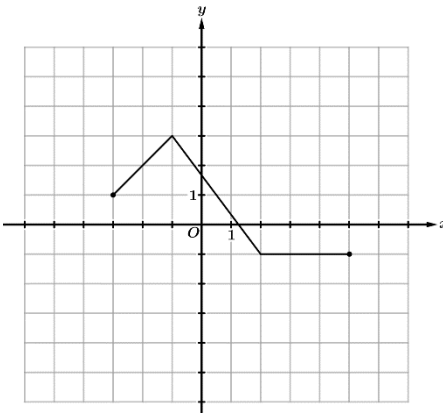
(b) Find  $w(h(-5))$ .

(c) Find  $w(w(2))$ .



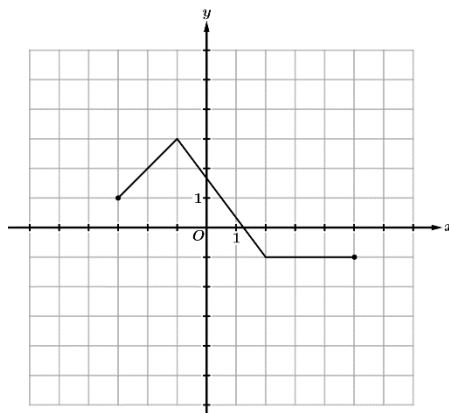
The graph of  $f(x)$  is shown in the figure above and consists of three line segments.

13. Let  $g(x) = -2f(x + 1)$ . Sketch the graph of  $g(x)$  on the same axes as  $f(x)$  above.



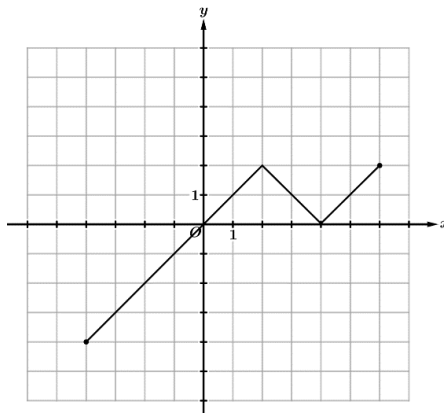
The graph of  $f(x)$  is shown in the figure above and consists of three line segments.

14. Let  $h(x) = f(2x) - 3$ . Sketch the graph of  $h(x)$  on the same axes as  $f(x)$  above.



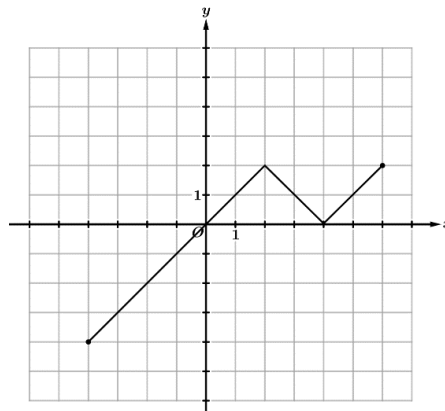
The graph of  $f(x)$  is shown in the figure above and consists of three line segments.

15. Let  $f(x) = 2k(x - 2) - 1$ . Sketch the graph of  $k(x)$  on the same axes as  $f(x)$  above.



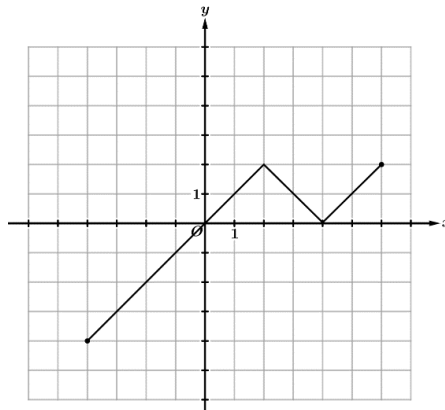
The graph of  $f(x)$  is shown in the figure above and consists of three line segments.

16. Let  $g(x) = 1 - f(2x)$ . Sketch the graph of  $g(x)$  on the same axes as  $f(x)$  above.



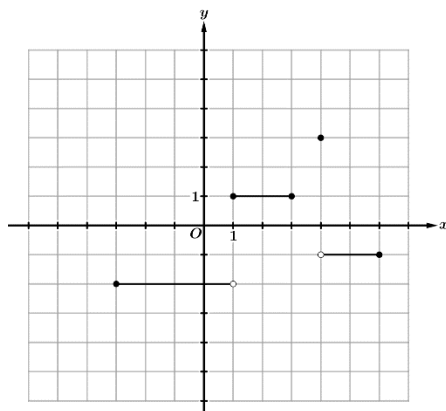
The graph of  $f(x)$  is shown in the figure above and consists of three line segments.

17. Let  $h(x) = f(x - 2) + 3$ . Sketch the graph of  $h(x)$  on the same axes as  $f(x)$  above.



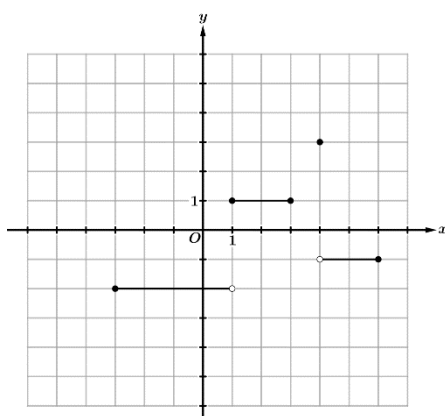
The graph of  $f(x)$  is shown in the figure above and consists of three line segments.

18. Let  $f(x) = 2k(x + 1)$ . Sketch the graph of  $k(x)$  on the same axes as  $f(x)$  above.



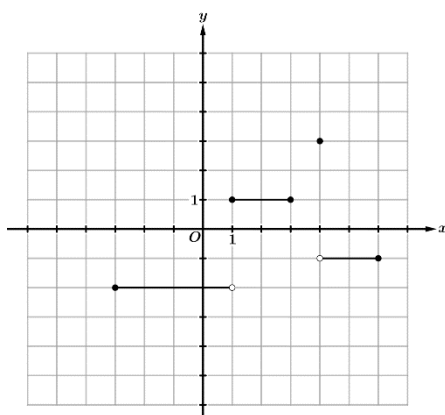
The graph of  $f(x)$  is shown in the figure above and consists of three linear pieces and a point at  $(4, 3)$ .

19. Let  $g(x) = 2f(x + 3) - 1$ . Sketch the graph of  $g(x)$  on the same axes as  $f(x)$  above.



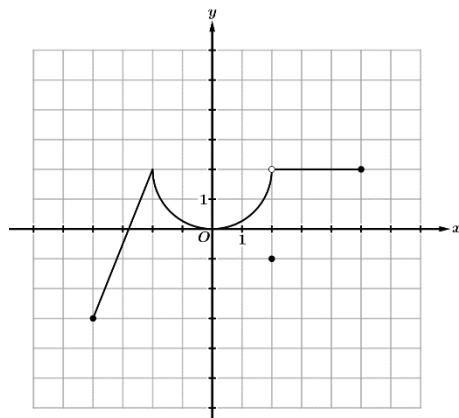
The graph of  $f(x)$  is shown in the figure above and consists of three linear pieces and a point at  $(4, 3)$ .

20. Let  $h(x) = f(2x - 2) - 4$ . Sketch the graph of  $h(x)$  on the same axes as  $f(x)$  above.



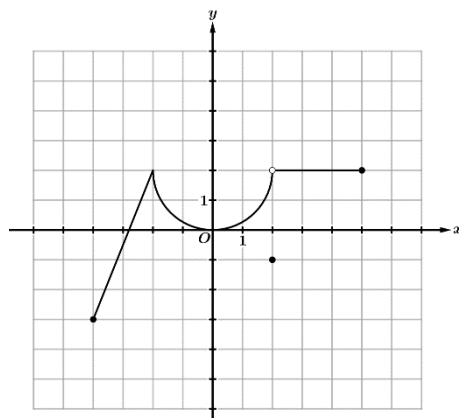
The graph of  $f(x)$  is shown in the figure above and consists of three linear pieces and a point at  $(4, 3)$ .

21. Let  $k(x)$  be the function that results from applying three transformations to the graph of  $f$  in this order: a vertical dilation by a factor of 2, a reflection over the  $y$  axis, and a vertical translation by  $-1$  unit. Sketch the graph of  $k(x)$  on the same axes as  $f(x)$  above.



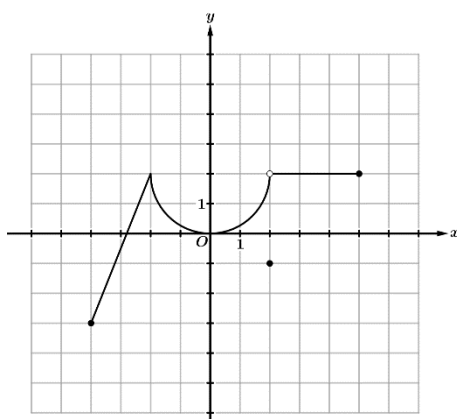
The graph of  $f(x)$  is shown in the figure above and consists of two linear pieces, a semi-circle, and a point at  $(2, -1)$ .

22. Let  $g(x) = -f(2x)$ . Sketch the graph of  $g(x)$  on the same axes as  $f(x)$  above.



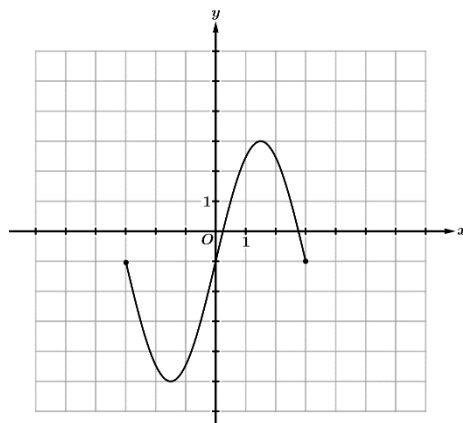
The graph of  $f(x)$  is shown in the figure above and consists of two linear pieces, a semi-circle, and a point at  $(2, -1)$ .

23. Let  $h(x) = f(-x) + 2$ . Sketch the graph of  $h(x)$  on the same axes as  $f(x)$  above.



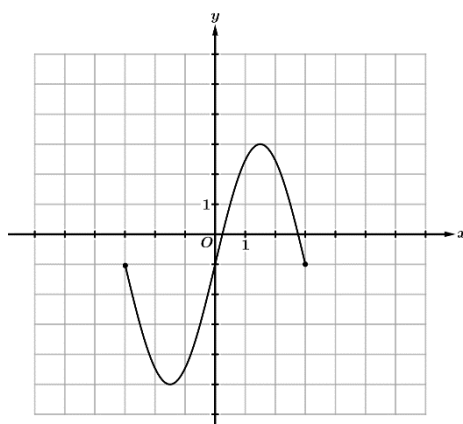
The graph of  $f(x)$  is shown in the figure above and consists of two linear pieces, a semi-circle, and a point at  $(2, -1)$ .

24. Let  $k(x)$  be the function that results from applying three transformations to the graph of  $f$  in this order: a horizontal dilation by a factor of  $\frac{1}{2}$ , a reflection over the  $x$  axis, and a vertical translation by 2 units. Sketch the graph of  $k(x)$  on the same axes as  $f(x)$  above.



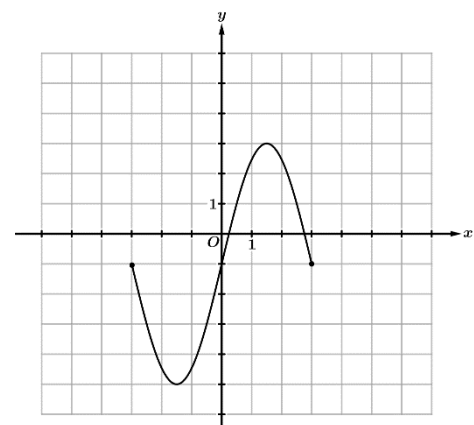
The graph of  $f(x)$  is shown in the figure above and has the domain  $[-3, 3]$  and the range  $[-5, 3]$ .

25. Let  $g(x) = f(x + 2) - 1$ . Sketch the graph of  $g(x)$  on the same axes as  $f(x)$  above.



The graph of  $f(x)$  is shown in the figure above and has the domain  $[-3, 3]$  and the range  $[-5, 3]$ .

26. Let  $h(x) = 1 - f\left(\frac{x}{2}\right)$ . Sketch the graph of  $h(x)$  on the same axes as  $f(x)$  above.



The graph of  $f(x)$  is shown in the figure above and has the domain  $[-3, 3]$  and the range  $[-5, 3]$ .

27. Let  $k(x) = -3f(2x) + 1$ .

Find the domain and range of  $k(x)$ .

28. Let  $p(x) = \frac{1}{2}f(x + 3) - 4$ .

Find the domain and range of  $p(x)$ .



29. The graph of  $f(x)$  has zeros at  $x = -2, 0$ , and  $3$ . Find the zeros of the following functions.

(a)  $g(x) = 2f(x - 4)$                       (b)  $h(x) = -\frac{1}{3}f(2x)$                       (c)  $k(x) = -5f(3x - 2)$

30. The graph of  $f(x)$  has the vertical asymptote  $x = -2$  and horizontal asymptote  $y = 3$ . Find the vertical and horizontal asymptotes of the following functions.

(a)  $g(x) = 2f(x + 1) - 3$                       (b)  $h(x) = 4 - 3f\left(\frac{x}{5}\right)$                       (c)  $k(x) = \frac{1}{2}f(4 - 2x) + 3$

31. The graph of  $f(x)$  is continuous where  $\lim_{x \rightarrow -\infty} f(x) = 4$  and  $\lim_{x \rightarrow \infty} f(x) = -\infty$ .

(a) If  $g(x) = -2f(x + 7) + 5$ , find  $\lim_{x \rightarrow -\infty} g(x)$  and  $\lim_{x \rightarrow \infty} g(x)$ .

(b) If  $h(x) = -f(-x)$ , find  $\lim_{x \rightarrow -\infty} h(x)$  and  $\lim_{x \rightarrow \infty} h(x)$ .

32. The graph of  $f(x)$  has the vertical asymptote  $x = 5$  and horizontal asymptote  $y = -3$ . Find the vertical and horizontal asymptotes of the following functions that result from transforming the graph of  $f$ .

(a) The graph of  $g$  results from applying the following transformations to graph of  $f$  in this order: vertical dilation by a factor of 3, reflection over the  $x$  axis, reflection over the  $y$  axis, and a horizontal translation by  $-3$  units.

(b) The graph of  $h$  results from applying the following transformations to graph of  $f$  in this order: horizontal dilation by a factor of 2 and a horizontal translation by 4 units.

33. Let  $f(x) = x^2 + 4x + 1$ . Write an equation of the following functions that are transformations of  $f(x)$ .

(a)  $g(x) = 3f(x) - 7$

(b)  $h(x) = -2f(x) + 2$

(c)  $k(x) = f(x - 2)$

(d)  $m(x) = f\left(\frac{x}{2}\right) + 3$

(e)  $p(x) = 2f(x + 1) - 5$

(f)  $s(x) = -f(-x)$

34. Let  $f(x) = \frac{x - 1}{(x + 2)(x - 3)}$ . Write an equation of the following functions that are transformations of  $f(x)$ .

(a)  $g(x) = f(x + 4)$

(b)  $h(x) = -2f\left(\frac{x}{3}\right)$

(c)  $k(x) = f(4 - x)$

35. Let  $f(x) = 2x^2 - 3$ . Write an equation of the following functions that are transformations of  $f(x)$ .

(a)  $g(x) = f(2x - 3) + 2$

(b)  $h(x) = 4f(x) + 1$

(c)  $k(x)$  results when the graph of  $f$  has a horizontal dilation by a factor of 3, followed by a horizontal translation by  $-5$  units, and a vertical translation by 2 units.