Absolute Value Functions Practice Questions

Absolute Value Functions: Basics

1) For each of the absolute value functions below, determine
   a) the coordinates of the vertex
   b) the slope of each of the rays defining the function

$f(x) = 0.5|x - 7| + 2$
Vertex: $(7, 2)$ Slopes are 0.5 and -0.5

$g(x) = -3|x + 4| - 5$
Vertex: $(-4, -5)$ Slopes are 3 and -3

$h(x) = -4|2x + 6| - 4$
Vertex: $(-3, -4)$ Slopes are 8 and -8

$i(x) = 5|-3x - 9| + 2$
Vertex: $(-3, 2)$ Slopes are 15 and -15

2) Write each of the following rules such that $b = 1$

a) $f(x) = |2x - 6|$
$= 2|x - 3|$

b) $g(x) = -|3x + 9| - 2$
$= -3|x + 3| - 2$

c) $h(x) = -2|4 - 2x| + 1$
$= -4|x - 2| + 1$

d) $i(x) = |3x - 12| + 5$
$= 3|x - 4| + 5$

e) $j(x) = -\frac{1}{3}|6x - 4| - 4$
$= -2\left|x - \frac{2}{3}\right| - 4$

f) $k(x) = -2|3 - 2x| + 6$
$= -4|x - 1.5| + 6$

3) Given $f(x) = |x - 4| + 2$ and $g(x) = |x - 4| - 6$, find the rule that corresponds to:

a) $f + g$
$= 2|x - 4| - 4$

b) $f - g$
$= 8$

c) $g - f$
$= -8$

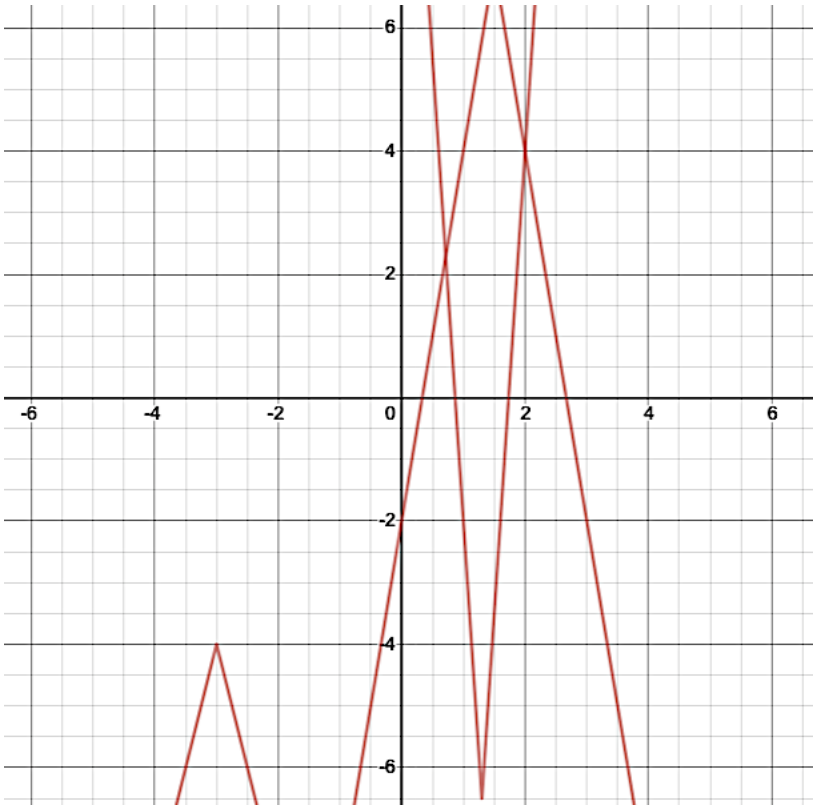
Absolute Value Functions: Graphing

4) Graph each of the following functions:

a) $f(x) = -4|x + 3| - 4$

b) $g(x) = -6|x - 1.5| + 7$

c) $h(x) = 3|6.5 - 5x| - 6.5$

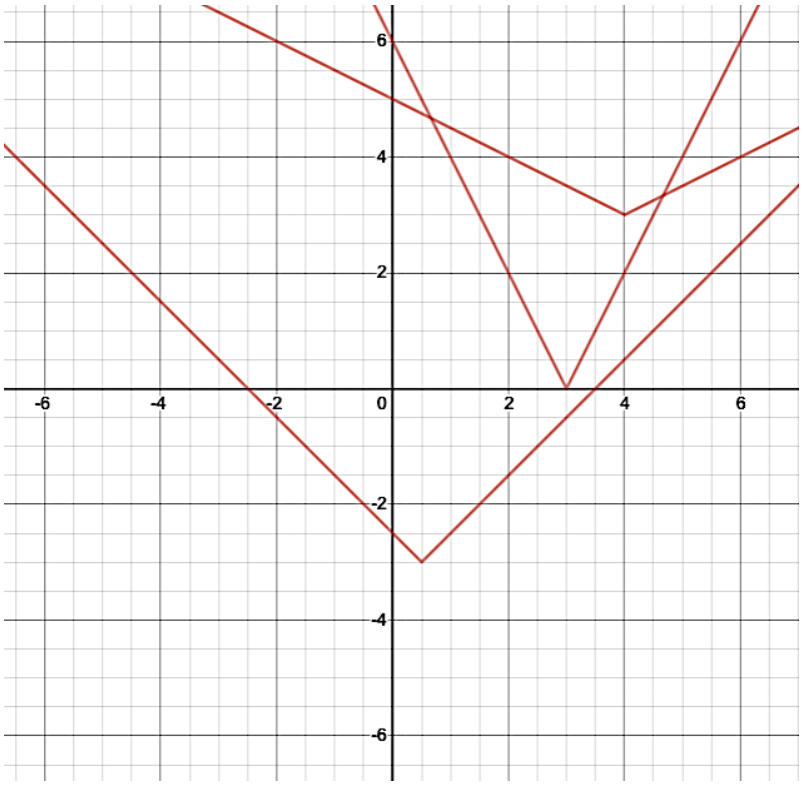


5) Graph each of the following functions

a) $f(x) = \frac{|2-4x|}{4} - 3$

b) $g(x) = |2x - 6|$

c) $h(x) = \frac{1}{2}|x - 4| + 3$



Absolute Value Functions: Finding the Rule

6) Below is a table of values for an absolute value function. Determine the rule

x	y
-3	6
-2	4
-1	2
0	4
1	6
1	8
3	10

$$\boldsymbol{f(x) = 2|x + 1| + 2}$$

7) Find the rules of the absolute value functions below:

a) a vertex at $(3, 5)$ and passes through the point $(5, 8)$

$$\boldsymbol{f(x) = \frac{3}{2}|x - 3| + 5}$$

b) passes through the points (2, 11), (6, 11), and (4, 5)

$$\boldsymbol{f(x) = 3|x - 4| + 5}$$

c) passes through the points $(-4, -5), (-6, -6), (5, -7.5), \text{and } (8, -9)$

$$\boldsymbol{f(x) = -0.5|x + 2| - 4}$$

d) has a maximum of 6 and zeros of -2 and 6

$$\boldsymbol{f(x) = -\frac{3}{2}|x - 2| + 6}$$

e) the curve intersects the axes at $(-3, 0), (1, 0), \text{and } \left(0, \frac{3}{2}\right)$

$$\boldsymbol{f(x) = -\frac{3}{2}|x + 1| + 3}$$

Absolute Value Functions: Solving Equalities

8) Find the zero(s) of each of the functions below:

a) $f(x) = |2 - x| - 5$

$x = -3 \text{ and } x = 7$

b) $g(x) = \frac{1}{3}|2x - 1| + 5$

no solutions

c) $h(x) = -2|3 - 2x| + 6$

$x = 0 \text{ and } x = 3$

9) Solve the following equations

a) $5 = 2|x + 6| - 7$

$x = 0 \text{ and } x = -12$

b) $7 = 3|x + 4| + 10$

no solutions

c) $18 = \frac{4|x|+36}{2}$

$x = 0$

d) $14 = -4|x| + 20$

$x = \frac{3}{2} \text{ and } x = -\frac{3}{2}$

e) $3|x + 22| - 5 = 10$

$x = -17 \text{ and } x = -27$

f) $-16 = 2|9 - 7x| - 24$

$x = \frac{5}{7} \text{ and } x = \frac{13}{7}$

10) Given $f(x) = |3x - 2| - 1$, find the value(s) of x such that:

a) $f(x) = 0$

$x = 1 \; and \; x = \frac{1}{3}$

b) $f(x) = 4$

$x = \frac{7}{3} \; and \; x = -1$

11) For each of the following absolute value functions, determine

i) the domain and range ii) the zeros iii) the variation iv) the sign

a) $f(x) = 3|x - 2| + 4$

Domain: $]-\infty, +\infty[$

Range: $[4, +\infty[$

No Zeros

Decreasing: $]-\infty, 2]$

Increasing: $[2, +\infty[$

Positive: $]-\infty, +\infty[$

b) $g(x) = |3x - 12| + 5$

Domain: $]-\infty, +\infty[$

Range: $[5, +\infty[$

No Zeros

Decreasing: $]-\infty, 4]$

Increasing: $[4, +\infty[$

Positive: $]-\infty, +\infty[$

c) $h(x) = -2|4 - 2x| + 1$

Domain: $]-\infty, +\infty[$

Range: $]-\infty, 1]$

Zeros at $x = \frac{7}{4} and \; x = \frac{9}{4}$

Decreasing: $[2, +\infty[$

Increasing: $]-\infty, 2]$

Positive: $\left[\frac{7}{4}, \frac{9}{4}\right]$

Negative: $\left]-\infty, \frac{7}{4}\right] \cup \left[\frac{9}{4}, +\infty\right[$

Absolute Value Functions: Solving Inequalities

12) Solve the following inequalities

a) $2|3x-6|<18$

$]-1,5[$

b) $|3+5x|-4\geq 6$

$\left]-\infty,-\frac{13}{5}\right]\cup\left[\frac{7}{5},+\infty\right[$

c) $-7<8|x+9|-15$

$]-\infty,-10[\cup]-8,+\infty[$

d) $18\geq -2|5-x|+36$

$]-\infty,-4]\cup[14,+\infty[$

e) $|9x-7|+20>-14$

$]-\infty,+\infty[$

f) $3>-2|18-x|+29$

$]-\infty,5]\cup[31,+\infty[$

13) Given $f(x)=2|3x+4|-8$ and $g(x)=2x$ determine the interval over which

a) $f(x)\geq g(x)$

$]-\infty,-2]\cup[0,+\infty[$

b) $f(x)<g(x)$

$]-2,0[$

Absolute Value Functions: Word Problems

14) On "cheap" Tuesday, a movie theatre sells adult and child tickets at the same price. The revenue, *R*, in dollars, is given by $R(x) = 750 - 75|10 - 2x|$, where *x* is the price of one ticket (in dollars). Last Tuesday, the revenue collected was $375. What is a possible "cheap" price charged for a single ticket?

The "cheap" price was either $2.50 or $7.50

15) The rule $n = -0.25|t - 4| + 6$ refers to the water level, *n* (in m) of a waterway according to the time (in days) elapsed since the start of the month of May. This waterway is navigable only when the water level is at least 5m. In the month of May, during what period of time was this waterway navigable?

The waterway was navigable for the first 8 days of May.

16) A photovoltaic solar system is composed of a solar panel, a charge controller, and a battery. The voltage *T* (in V) of the terminals of the solar panels is given by the rule $T = -1.5|x - 12| + 17$ where *x* represents the time (in h) elapsed since sunrise. To avoid damaging the battery, the charge controller breaks the circuit when the voltage at the terminals of the solar panels is greater than or equal to 14.3 V. For how long is the circuit broken?

The circuit is broken for 3.6 hours.

17) In mid-March a group of meteorologists records the total accumulation of snowfall over a 36 h period, using an observation deck designed specifically for that purpose. An analysis of the data establishes that the depth of snow, in cm, varies according to the rule $A(t) = \frac{2}{3}|t - 15| + 6$ where *t* is the time in hours.

a) On the deck, what was:

1) The maximum depth of snow? 20cm
2) The minimum depth of snow? 6 cm

b) At what time was the total depth of snow 10 cm? At $t = 9\ hours$ and $t = 21\ hours$