LG #14
Absolute Values
Part 1 - Functions

Agenda:

Absolute Values are the distance of that number

from zero.   **Example:**

$$|-4| = 4 \qquad |4| = 4$$

-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6

4 units   4 units

Topic 1

Example 1

**Determining the Absolute Value
of a Number**

Evaluate the following.

a) $|6|$ *b)* $|-12|$ *c)* $|0|$

Example 2
Compare and Order Absolute Values

Write the real numbers in order from least to greatest.

$$\left| -2.3 \right|, \quad 1, \quad \left| 3.1 \right|, \quad \left| \frac{-12}{7} \right|, \quad -1.9, \quad \left| 1\frac{7}{9} \right|$$

1 st- Evaluate each number and express as decimal.

$$2.3, \quad 1, \quad 3.1, \quad 1.7, \quad -1.9, \quad 1.8$$

2 nd- Rearrange from least to greatest.

$$-1.9, \quad 1, \quad 1.7, \quad 1.8, \quad 2.3, \quad 3.1$$

3 rd- Show as the original numbers from least to greatest.

$$-1.9, \quad 1, \quad \left| \frac{-12}{7} \right|, \quad \left| 1\frac{7}{9} \right|, \quad \left| -2.3 \right|, \quad \left| 3.1 \right|$$

Example 3
Evaluating Absolute Value Expressions

Evaluate the following.

$a)\ \left|\,2\,\right| + \left|\,-7\,\right|$ $\qquad$ $b)\ \left|\,-4\,\right| - \left|\,2-7\,\right|$ $\qquad$ $c)\ 8 - 2\left|\,1-4\,\right|$

Evaluate each absolute, and apply the order of operation to evaluate the expression.

$= 2 + 7$ $\qquad\qquad$ $= 4 - \left|\,-5\,\right|$ $\qquad\qquad$ $= 8 - 2\left|\,-3\,\right|$

$= 9$ $\qquad\qquad\qquad\quad$ $= 4 - 5$ $\qquad\qquad\qquad$ $= 8 - 2(3)$

$\qquad\qquad\qquad\qquad\qquad$ $= -1$ $\qquad\qquad\qquad\quad$ $= 8 - 6$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ $= 2$

Example 4
Absolute in a Word Problem

A stock market fluctuates a great deal in a month. A particular stocks opened the month at $13.55 per share, dropped to $12.70, increased to $14.05, and closed the month at $13.85. Determine the total change in the value of this stock that month.

Stock Value: $V_1 = 13.55$, $V_2 = 12.70$, $V_3 = 14.05$, $V_4 = 13.85$

$$|V_2 - V_1| + |V_3 - V_2| + |V_4 - V_3|$$
$$= |12.70 - 13.55| + |14.05 - 12.70| + |13.85 - 14.05|$$
$$= |-0.85| + |+1.35| + |-0.20|$$
$$= 0.85 + 1.35 + 0.20$$
$$= 2.40$$

Try: 1. Evaluate the following.

a) $|2-5| + |-3-8| - |4|$

b) $|-5| - 4|-3+6| - |2(-3)^2 - 15|$

2. Write the real numbers in order from least to greatest.

$|0.3|, \; |-0.7|, \; 1.2, \; |0|, \; \left|\dfrac{1}{4}\right|, \; -2$

3. On day at work you ride the elevator from the first floor up to the sixth floor, down to the second floor, then up to the fourth floor and finally down to the first floor. What was the total change in floors?

Topic 2   **Example 1**

Graph an Absolute Value Function
in the form y = |ax+b|

Consider the absolute value function y = |2x - 3|

a) Determine the y-intercept and the x-intercept.

b) Sketch the graph.

c) State the domain and range.

d) Express as a piecewise function.

a) To determine the   **To determine the**
y-intercept, let x=0   **x-intercept, let y=0**
and solve for y.   **and solve for x.**

$$y = |\, 2x - 3\,|$$ $$y = |\, 2x - 3\,|$$

$$y = |\, 2\,(\,\mathbf{0}\,) - 3\,|$$ $$\mathbf{0} = |\, 2x - 3\,|$$

$$y = |\,-3\,|$$ $$0 = 2x - 3$$

$$y = 3$$ $$3 = 2x$$

                                 The x-intercept

The y-intercept = $(0, 3)$ $$x = \frac{3}{2} \ \ or \ \ 1.5$$ **$= (1.5, 0)$**

b) 1   Sketch using the Graph of $y = 2x - 3$
    to graph $y = |2x - 3|$

Slope   y-intercept
  2   -3

$y = |2x - 3|$

$y = 2x - 3$

2nd Take some points below $y = 0$ line :

$y = $ -1,
       -3,
       -5

then take the absolute values of them : $y = |f(x)|$

       1,
       3,
       5

Now plot them straight up from their original point.

y = 2x - 3

Another Method to Graph an Absolute Value Function.

☺ **Use a Table of Values:** create a table of values using the x-intercept and x values to the right and left of it.

x	$y = \lvert 2x - 3 \rvert$
-1	5
0	3
1.5	0
1	1
2	1
3	6
4	5

c) **Domain is** *all Real Numbers* **or** $\langle x | x \in R \rangle$

Range is $\langle y | y \geq 0, y \in R \rangle$

d) **The V-shaped graph of the absolute value function** $y = |2x - 3|$ **is composed of two separate linear functions :** $y = 2x - 3$

$y = -(2x - 3) \; or \; y = -2x + 3$

Thus, the piecewise function is

$y = 2x - 3 \, , \, if \; x \geq 1.5$

$y = -(2x - 3) \, , \, if \; x < 1.5$

Example 2
Graph an Absolute Value Function
in the form y = |ax +bx+c|

Consider the absolute value function $y = |{-}x + 2x + 8|$

a) Determine the y-intercept and the x-intercept.

b) Sketch the graph.

c) State the domain and range.

d) Express as a piecewise function.

Do the same steps as you did in Example 1.

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a) y-intercept

$y = |-x^2 + 2x + 8|$

x-intercepts

$y = |-x^2 + 2x + 8|$

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b) Graph $y = |-x^2 + 2x + 8|$

1 st - **graph** $y = -x^2 + 2x + 8$

• **to do this**
   use your intercepts

y-int (0,8); *x*-int (-2,0)&(4,0)

c) Domain:
  Range:

d) Piecewise function:

Try:

Consider the absolute value function $y = |-x + 4|$

a) Determine the y-intercept and the x-intercept.

b) Sketch the graph.

c) State the domain and range.

d) Express as a piecewise function.

c) Domain:

   Range:

d) Piecewise Function

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