

"Real"
ACT
2nd Ed.
PT3

① On the real number line, WHAT is the midpoint of -5 and 17?

② If $3\frac{3}{5} = x + 2\frac{2}{3}$, then $x =$?

③ A system of linear equations is shown below.

$$3y = -2x + 8$$

$$3y = 2x + 8$$

Which of the following describes the graph of this system of linear equations in the standard (x, y) coordinate plane?

- Ⓐ Two distinct intersecting lines.
- Ⓑ Two parallel lines with positive slope.
- Ⓒ Two parallel lines with negative slope.
- Ⓓ A single line with positive slope.
- Ⓔ A single line with negative slope.

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- Time permitting $\Rightarrow$ review HW 5; Quiz 4
 - Best practice problems $\Rightarrow$ Real ACT
 - Best topic-by-topic study guide $\Rightarrow$ Barrons

$$\textcircled{1} \quad m.d \Rightarrow \frac{-5+17}{2} = \boxed{6}$$

$$\textcircled{2} \quad 3\frac{3}{5} = x + 2\frac{2}{3}$$

$$15 \cdot \frac{18}{5} = \left(x + \frac{8}{3}\right) \cdot 15$$

$$54 = 15x + 40$$

$$14 = 15x$$

$$\boxed{\frac{14}{15} = x}$$

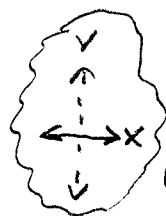
$$\textcircled{3} \quad 3y = -2x + 8 \quad y = -\frac{2}{3}x + \frac{8}{3}$$

$$3y = 2x + 8 \quad y = \frac{2}{3}x + \frac{8}{3}$$

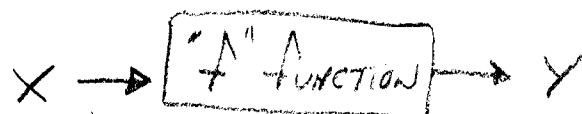
two distinct intersecting lines

Functions of Two Variables

$y = f(x) = 2x + 1$ is a function "of"

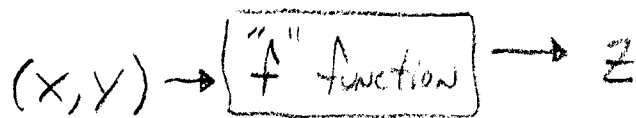


one variable, x . The domain is all allowable values of x . The range is all allowable values of $2x + 1$. Each x corresponds with one y .



$z = f(x, y) = 2x + 3y$ is a function "of"

two variables, x and y . The domain is all allowable values of x and y . Or in graphing terms, any allowable (x, y) pair. The range is all allowable values of $2x + 3y$. Each (x, y) corresponds with one z .



Ex) Find $f(4, 5)$

$$(4, 5) \rightarrow \boxed{2(4) + 3(5)} \rightarrow 23$$

$$f(4, 5) = 23.$$

OR, the ordered triple is $(4, 5, 23)$
 x, y, z

You have often used functions of two variables Although you may not have thought of them that way.

EX) The area of a rectangle formula is an area function of two variables base and height.

$$A = A(b, h) = bh$$

EX) Find $A(4, 6)$

$$A(b, h) = bh$$

$$A(4, 6) = (4)(6) = 24 \text{ units}^2$$

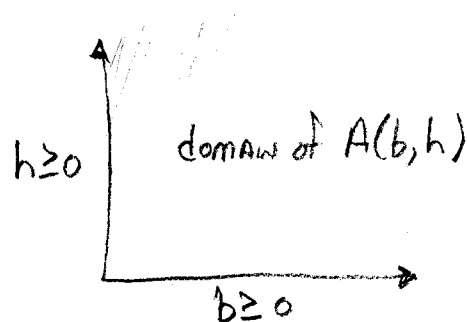
Are there any restrictions on the domain of this function?

$$b \geq 0$$

Since length $\neq$ negative

$$h \geq 0$$

$\therefore (b, h)$ must be in Quadrant I



Summary - how to find the value of
any function of two variables?

Same way as you do a function of 1 variable.

- Rewrite original function
- Directly below it substitute the domain

Ex) $f(x, y) = 5x - y$ $g(x, y) = x + y$

① Find $f(1, -6)$

$$f(x, y) = 5x - y$$

$$\begin{aligned} f(1, -6) &= 5() - () \\ &= 5(1) - (-6) \\ &= 5 + 6 \end{aligned}$$

→ You would do
→ this on 1 line

$$\boxed{f(1, -6) = 11}$$

② Find $g(-2, 0)$

$$\begin{aligned} g(x, y) &= x + y \\ g(-2, 0) &= (-2) + (0) \end{aligned}$$

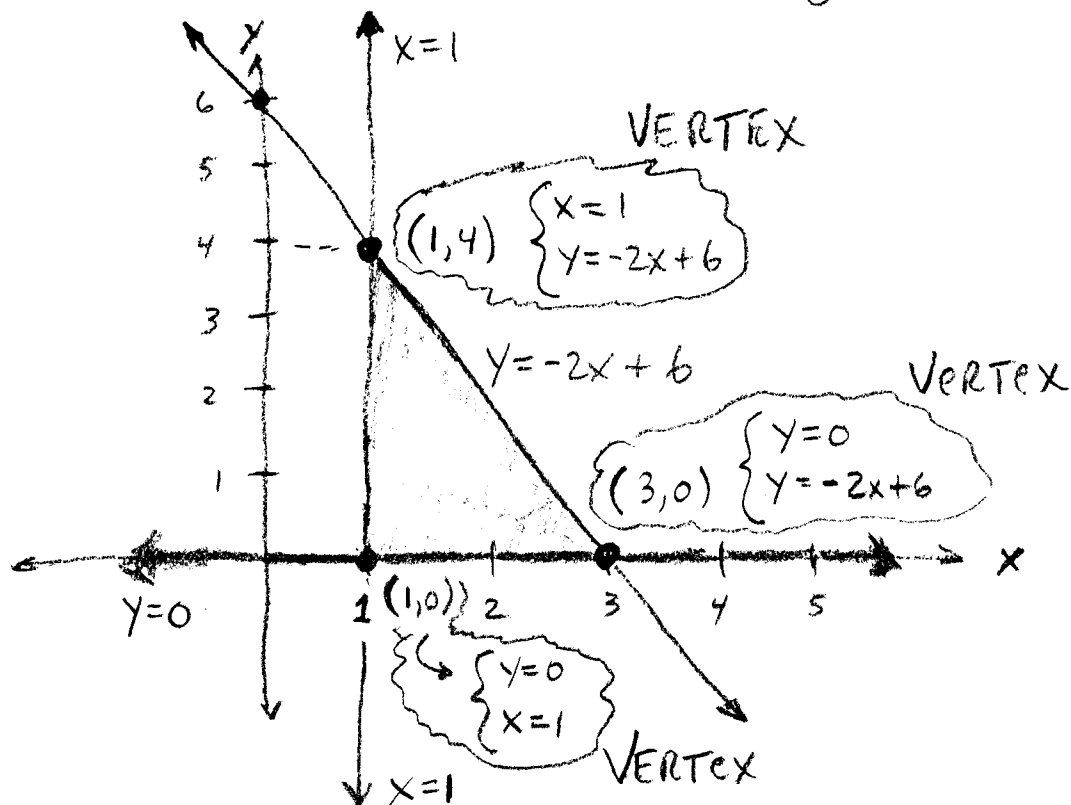
$$\boxed{g(-2, 0) = -2}$$

vertex THE point (x, y) formed by the intersection of 2 lines or line segments.

vertices $\Rightarrow$ PLURAL

Ⓔ The following system of inequalities forms 3 vertices when the boundary lines are graphed:

$$\begin{cases} x \geq 1 & \Rightarrow \text{vertical line at } x = 1 \\ y \geq 0 & \Rightarrow \text{horizontal line at } y = 0 \text{ i.e. the } x\text{-axis} \\ 2x + y \leq 6 & \Rightarrow \text{diagonal line at } y = -2x + 6 \end{cases}$$



Now, suppose you have a function of two variables whose domain is a set of (x, y) pairs in a shaded region defined by the graph of a system of linear inequalities (also called the "constraints").

This domain, if enclosed on all sides is called "bounded", if one side goes to ∞ it is called "unbounded".

A basic property of functions of 2 variables that have a domain that is bounded or unbounded by a system of linear inequalities is that if the function has a maximum or minimum value, it will be at one of the vertices!

Finding this max or min = Linear Programming = Ch. 3-4.

Steps to solve a linear programming problem $\Rightarrow$

- Graph the system of linear inequalities

- Use EBS or EBA to find the coordinates of each vertex.

- Find $f(x, y)$ at each vertex and pick MAX or MIN as needed.

CONTINUE EXAMPLE 1 $\Rightarrow$ given $f(x, y) = 3x + y$
 Find the MAX and MIN values of the function.
 $\Rightarrow$ Find $f(x, y)$ AT each vertex

(x, y)	$f(x, y) = 3x + y$	
$(1, 4)$	$3(1) + (4) = 7$	
$(3, 0)$	$3(3) + (0) = 9$	$\Rightarrow$ MAX
$(1, 0)$	$3(1) + (0) = 3$	$\Rightarrow$ MIN

$f(x, y) = 9 = \text{MAXIMUM}$
$f(x, y) = 3 = \text{MINIMUM}$

Homework: • Read 3-4

• Pg. 132 # 3, 5 (Tip: 4 vertices)