

Precalculus
Section 1.3
Graphs of Functions

WARM UP

• WHAT ARE THE **TWO SCENARIOS** YOU HAVE TO WATCH OUT FOR WHEN FINDING DOMAIN?

- (1) zero in den.
- (2) Negative inside radical

• FIND THE DOMAIN OF THE FOLLOWING FUNCTIONS.

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

$x \neq -2$

$$g(x) = \sqrt{x-2}$$

$x \geq 2$ $[2, \infty)$

$x-2 \geq 0$
 $+2 \quad +2$
 $\hline x \geq 2$

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DO NOW

• WHAT DOES THE DIFFERENCE QUOTIENT REPRESENT?

Slope

• FIND THE DIFFERENCE QUOTIENT

$$\frac{f(x+h) - f(x)}{h}, h \neq 0 \text{ when } f(x) = 5x^2$$

① $f(x+h) = 5(x+h)^2$
 $= 5(x^2 + 2xh + h^2)$
 $= 5x^2 + 10xh + 5h^2$

② $f(x) = 5x^2$

$$\frac{5x^2 + 10xh + 5h^2 - 5x^2}{h}$$

$\frac{h(10x+5h)}{h}$
 $10x+5h; h \neq 0$

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What questions do you have from 1.2?

90, 88, 92, 91

$$f(x) = \frac{4}{x+1}$$

$$\frac{f(x) - f(7)}{x-7} \quad x \neq 7, -1$$

① $f(x) = \frac{4}{x+1}$

$$2 \cdot \frac{4}{x+1} - \frac{1(x+1)}{2(x+1)}$$

② $f(7) = \frac{4}{7+1} = \frac{1}{2}$

$$\frac{8}{2(x+1)} - \frac{x+1}{2(x+1)}$$

$$\frac{8-x-1}{2(x+1)}$$

$$\frac{7-x}{2(x+1)}$$

$$\frac{7-x}{2(x+1)} \cdot \frac{1}{x-7}$$

$$\frac{-1(-7-x)}{2(x+1)} \cdot \frac{1}{x-7}$$

$$\frac{-1}{2(x+1)} \quad x \neq 7, -1$$

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Find your group. Each member should complete the following on his/her own paper. Work as a group. This is the first problem for tonight's homework (so be sure you each have your own copy).

will come back to this if time permits

74. **Exploration** An open box of maximum volume is to be made from a square piece of material, 24 centimeters on a side, by cutting equal squares from the corners and turning up the sides (see figure).

(a) The table shows the volume V (in cubic centimeters) of the box for various heights x (in centimeters). Use the table to estimate the maximum volume.

Height, x	Volume, V
1	484
2	800
3	972
4	1024
5	980
6	864

$(0, 12)$

$$x(24-2x)(24-2x)$$

$$x(576-48x-48x+4x^2)$$

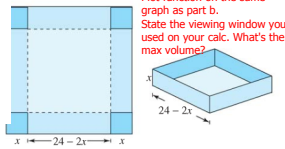
$$x(4x^2-96x+576)$$

$$V(x) = 4x^3 - 96x^2 + 576x$$

(b) Plot the points (x, V) from the table in part (a). Does the relation defined by the ordered pairs represent V as a function of x ? (Is the relation a function?)

(c) If V is a function of x , write the function and determine its domain.

(d) Use a graphing utility to plot the data from the table in part (a) with the function from part (c). How closely does the function represent the data? Explain.



Plot function on the same graph as part b. State the viewing window you used on your calc. What's the max volume?

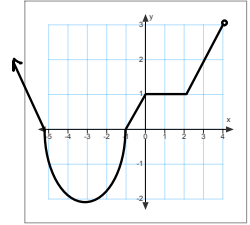
1.3: Graphs of Functions

Let's explore the properties of the piece-wise _____ graphed below.

1) Find the Domain & Range.

Domain: $(-\infty, 4)$

Range: $[-2, \infty)$



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2) State the intervals in terms of x where the function is increasing, decreasing or constant.

Note: by definition, these will always be open intervals.

Increasing:

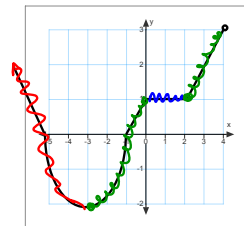
$$(-3, 0) \cup (2, 4)$$

Decreasing:

$$(-\infty, -3)$$

Constant:

$$(0, 2)$$



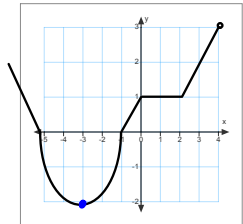
3) Define any relative minima or maxima.

Min(s): $(-3, -2)$

Max(s): None

Q: What changes at relative maxima or minima?

A: Dec/inc Switches direction



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4) In terms of x , where is $f(x) > 0$?
 $(-\infty, -5) \cup (-1, 4)$

In terms of x , where is $f(x) \leq 0$?
 $[-5, -1]$

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Now try one on your own. Use a graphing calculator to graph the function.

- State domain and range.
- State where the function is increasing, decreasing, or constant.
- State the relative minima and maxima (if they exist).
- State where $f(x) > 0$.

$$f(x) = x^{\frac{2}{3}} - 2$$

PS--What does $x^{\frac{2}{3}}$ mean again??

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SOME DEFINITIONS

THAT WILL AID US IN CALCULUS

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Even Functions

- 1) Graphically: a function is **even** if $f(x)$ is symmetric about the y -axis.
- 2) Algebraically: a function is **even** if $f(-x) = f(x)$.

Show $f(x) = x^2 + 5$ is **even** algebraically. Verify on your calculator.

$$f(-x) = (-x)^2 + 5 = x^2 + 5$$

Q: If f is even and (a,b) is a point on f , what other point do we know is also on f ?

A: $(-a, b)$

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Odd Functions

1) Graphically: a function is **odd** if $f(x)$ is symmetric about the **origin**.

2) Algebraically: a function is **odd** if $f(-x) = -f(x)$.

Show $f(x) = x^3 - x$ is odd algebraically. Verify on your calculator.

$$f(-x) = (-x)^3 - (-x)$$

$$= -x^3 + x$$

Q: If f is odd and (a,b) is a point on f , what other point do we know is also on f ?

A: $(-a, -b)$

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HOMEWORK
...how well do you know your calculus jargon?

1.3 (p. 38): 1-4, 19-22, 26, 29, 33, 35, 61, 67, 77, 79, 83-86
 (don't need to graph by hand first; just use a graphing calculator)

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Solutions of Equations

Equations in two variables, such as $x + y = 1$, have solutions that are ordered pairs (x, y) such that when the first coordinate is substituted for x and the second coordinate is substituted for y , the result is a true equation.

Example 1
 Find a solution to $x + y = 1$
 And another!
 And another!

Can you list all of the solutions?

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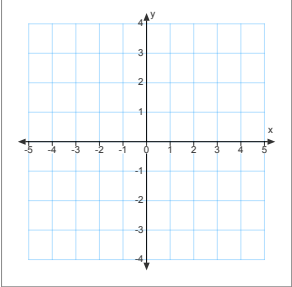
Graphs of Equations

The equation in Example 1 actually has an _____ number of solutions. Although we cannot individually list every solution, we can make a drawing (or a **graph**) to represent the solutions. One way to do this is to pick values for the independent variable (____) and find the corresponding values for the dependent variable (____). Plot the points you found and then connect them.

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Graphing Piecewise Functions

Graph $f(x) = \begin{cases} x^2 + 1, & x < 2 \\ \sqrt{x-2}, & x \geq 2 \end{cases}$



**OK, LET'S TALK ABOUT TWO IMPORTANT FUNCTIONS.
THIS MAY OR MAY NOT BE REVIEW.**

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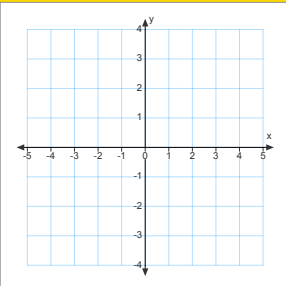
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Library of Parent Functions

Absolute Value Function $f(x) = |x|$

Domain:
Range:
Intercept:
Decreasing on:
Increasing on:
Even/Odd/Neither

How to enter in calculator:

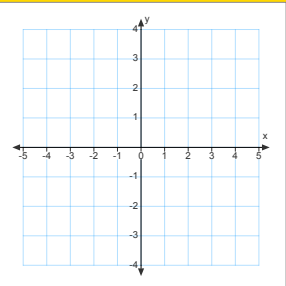


Library of Parent Functions

Greatest Integer Function $f(x) = \lceil x \rceil$

Domain:
Range:
y- Intercept:
x-Intercept: in the interval _____
Even/Odd/Neither

How to enter in calculator:



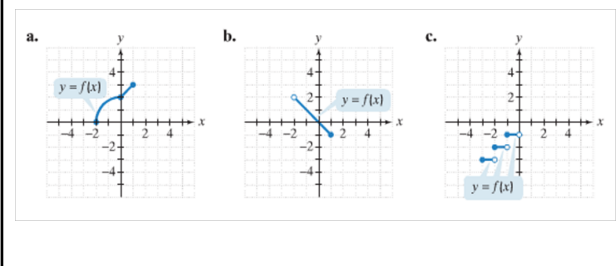
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Recall that the domain is the set of a function's inputs, found on the horizontal x -axis. The range is the set of a function's outputs, found on the vertical y -axis.

Example 2

Recall the definitions of domain and range again; then find the domain and range of each of these functions.



Dec 15-10:43 AM