



•Graphing Functions ---



1



•Graphing Functions --- without a calculator



2

You can do this!



3

Families of Functions



- The basic shape of many types of functions should become familiar to you



4

Families of Functions



- The basic shape of many types of functions should become familiar to you
- These types of functions are sometimes called Families of Functions



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Families of Functions



- Just like members of your family have similar characteristics



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Families of Functions



- Just like members of your family have similar characteristics
- Functions in the same family have similar characteristics



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Families of Functions



- Think of these functions as filling up a math tool box



8

Families of Functions



- Think of these functions as filling up a math tool box---tools in the tool box



9

Families of Functions



- Think of these functions as filling up a math tool box---tools in the tool box
- We have to put the right tool in the tool box



10

Families of Functions



- Think of these functions as filling up a math tool box---tools in the tool box
- We have to put the right tool in the tool box
- We have to know when to use the right tool



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Families of Functions



- Developing these math tool box skills---



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Families of Functions



- Developing these math tool box skills--- will help build math success!!



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Families of Functions

First question?



14

Families of Functions

What is a function?



15

Families of Functions

Function: The set of all ordered pairs (x,y) such that every x-value has a unique y-value



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Families of Functions

Function: *unique,...*
that means just one , right?



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Families of Functions

Function: so, every x-value in (x,y) has only one y-value!



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Families of Functions

Function: would you draw me a picture?



19

Families of Functions

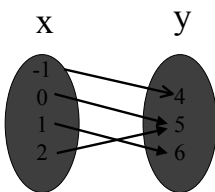
Function: sure, here goes...



20

Families of Functions

Every x value has **only one, unique** y value paired with it



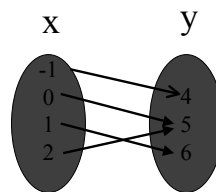
This is a **function**



21

Families of Functions

This is a **function**



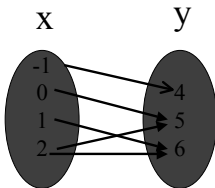
Math Alert
x values **cannot** be repeated but y values **can**



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Families of Functions

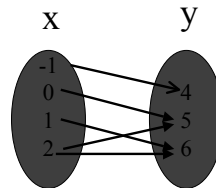
Add just **one more** arrow from 2...



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Families of Functions

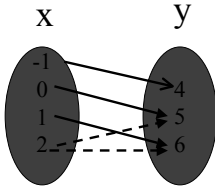
Now, 2 is associated with 5 **and** 6




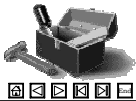
24

Families of Functions

Now, x
repeats
so this is
not a
function



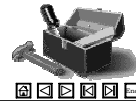

Math Alert
When an
x-value
repeats, it
has two--
or more--
arrows
from that
value



25

Families of Functions

Function: gee...what a
difference just one more
arrow makes



26

Families of Functions

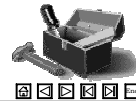
Function: so, you get the
function picture?



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Families of Functions

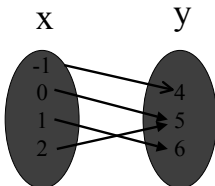
Function: I think so...



28

Families of Functions

This is
a function



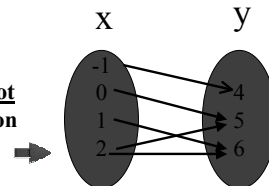
“x
doesn't
repeat”



29

Families of Functions

This is not
a function



“x
does
repeat”



30

Families of Functions

Function: I understand the function picture, but those pictures don't really look like graphs...



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Families of Functions

Function: how can I tell if a graph...is a function?



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Families of Functions

Function: there is actually a special test we can use



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Families of Functions

Function: it's called the vertical line test



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Families of Functions

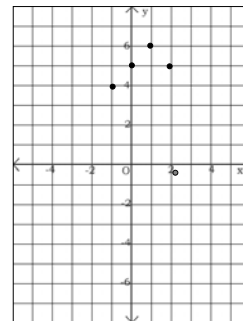
Function: first let's graph the ordered pairs that make up a function



35

Families of Functions

$(-1, 4)$
 $(0, 5)$
 $(1, 6)$
 $(2, 5)$



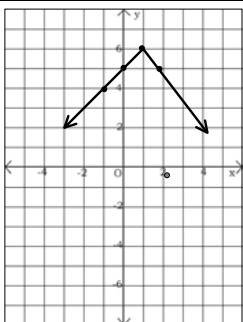
We put the ordered pairs on an x-y plane



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Families of Functions

- $(-1, 4)$
- $(0, 5)$
- $(1, 6)$
- $(2, 5)$



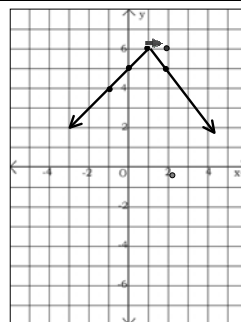
This could be a graph represented by the points that do represent a function



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Families of Functions

- $(-1, 4)$
- $(0, 5)$
- $(1, 6)$
- $\rightarrow (2, 6)$
- $(2, 5)$



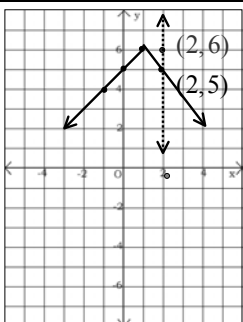
When we **add** a specific ordered pair we can't draw a smooth curve or line through the known points



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Families of Functions

- $(-1, 4)$
- $(0, 5)$
- $(1, 6)$
- $(2, 6)$
- $(2, 5)$



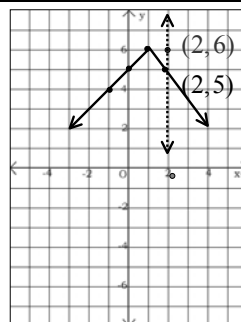
We can draw a vertical line through two of the ordered pairs



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Families of Functions

- $(-1, 4)$
- $(0, 5)$
- $(1, 6)$
- $(2, 6)$
- $(2, 5)$



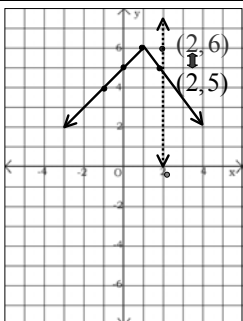
A vertical line through two or more ordered pairs indicates that x has been repeated



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Families of Functions

- $(-1, 4)$
- $(0, 5)$
- $(1, 6)$
- $(2, 6)$
- $(2, 5)$



x repeats
---no
function



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Families of Functions

Function: so...if a vertical line can be drawn through two or more of the x-values in a graph---
no function



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Families of Functions

Ok..I'll look out for
vertical lines 😊



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Families of Functions

What about those
family function
characteristics?



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Families of Functions

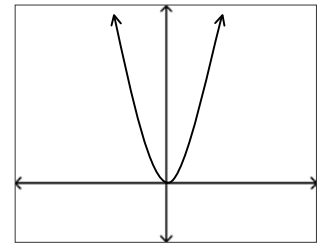
First of all, look at the
highest power of 'x'
in an equation...



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Families of Functions

↓
If $y=x^n$ and
n is a positive
even power,
like $y=x^2$
then the graph is
a parabola



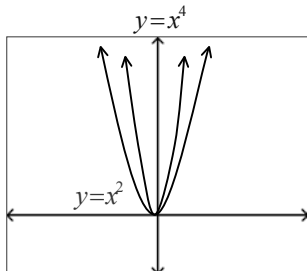
$$y=x^2$$



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Families of Functions

The greater the
even
power the more
“narrow” the graph
will become. It
will
still retain its
parabola
shape.



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Families of Functions

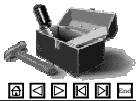
So, every equation
where the highest power
of x is even looks like a
parabola when it's
graphed...



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Families of Functions

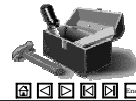
Right-o...put that in
your math tool box



49

Families of Functions

I can remember that---
even power---parabola



50

Families of Functions

What about equations
whose highest power of
'x' is an odd number?



51

Families of Functions

We will need to separate
the odd family a little...

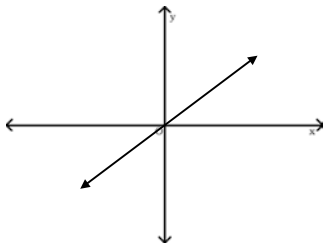


52

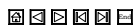
Families of Functions



If $y=x^n$ and
n is just a one,
then the graph is
linear---just a line

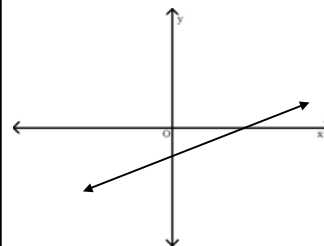


$$y=x^1 \quad \text{"just a one"}$$



53

Families of Functions



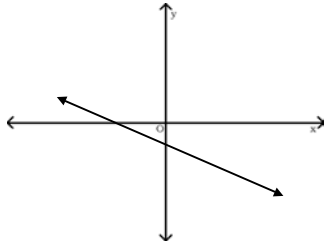
$$y=mx+b$$

And if $y=mx+b$
where m is the slope
and b is the y-intercept,
we still have "just a
line" since the 'x' power
is just a one



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Families of Functions



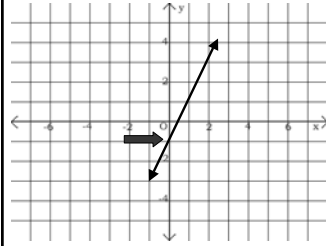
The line could have any slope and any y-intercept

$$y = mx + b$$



55

Families of Functions



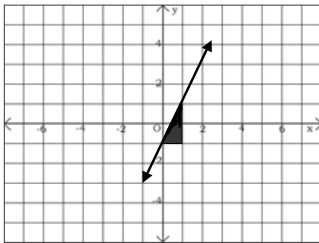
Here is a specific line graphed. The y-intercept is -1

$$y = 2x - 1$$



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Families of Functions



Here is a specific line graphed. The slope is 2

$$y = 2x - 1$$



57

Families of Functions

And if the odd power is not 'just a one'...

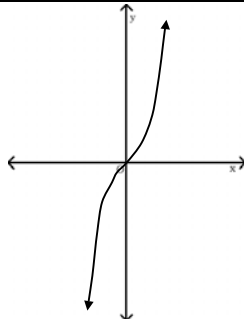


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Families of Functions



↓
If $y = x^n$ and n is a positive odd power, other than a one, like $y = x^3$ the graph will be an 'S-shaped' curve



$$y = x^3$$

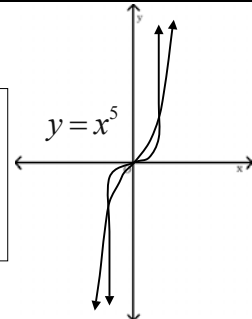


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Families of Functions



The more the odd power increases the more the "S" will be 'stretched'---gets closer to the y-axis



$$y = x^5$$



60

Families of Functions

Ok...I think I understand the even and odd families...



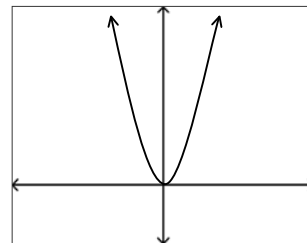
61

Families of functions



$$y=x^2$$

power is even—
parabola



$$y=x^2$$



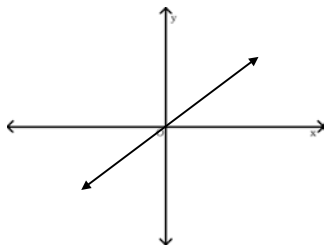
62

Families of functions



$$y=x^1$$

power is just one---
just a line



$$y=x^1$$



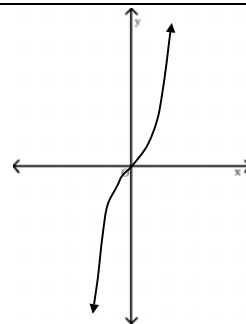
63

Families of functions



$$y=x^3$$

power is odd,
greater than one
S-shaped



$$y=x^3$$



64

Families of Functions

Are there any more
function families
I need to know about ?



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Families of Functions

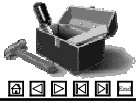
Just a few more...



66

Families of Functions

The absolute value function



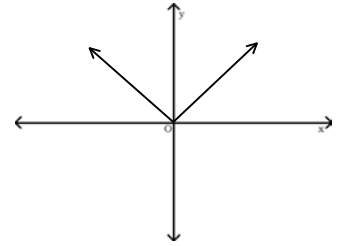
67

Families of Functions



$$y = |x|$$

“V-shaped”



$$y = |x|$$



68

Families of Functions

The square root function



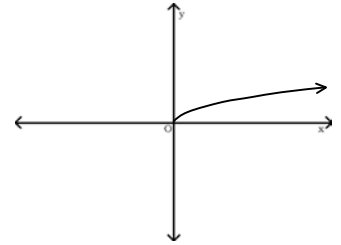
69

Families of Functions



$$y = \sqrt{x}$$

“half a parabola”



$$y = \sqrt{x}$$



70

Families of Functions

The cube root function



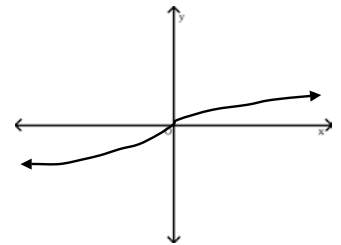
71

Families of Functions



$$y = \sqrt[3]{x}$$

“flat ‘s’”



$$y = \sqrt[3]{x}$$



72

Families of Functions

Let's review those basic family shapes...



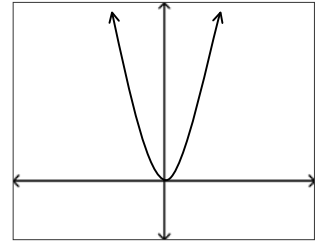
73

Families of Functions



$$y=x^2$$

power is even—
parabola



$$y=x^2$$



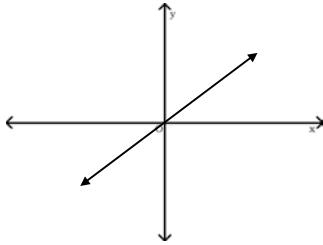
74

Families of Functions



$$y=x^1$$

power is just one---
just a line



$$y=x^1$$



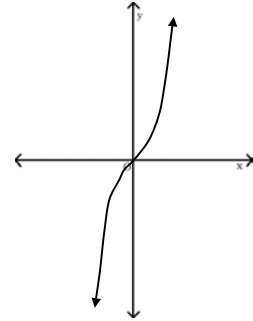
75

Families of Functions



$$y=x^3$$

power is odd, greater than one
'S-shaped'



$$y=x^3$$



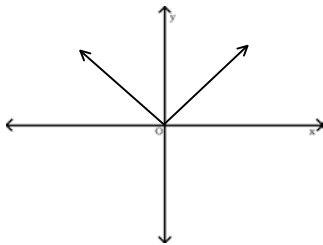
76

Families of Functions



$$y=|x|$$

absolute value---
V-shaped



$$y=|x|$$



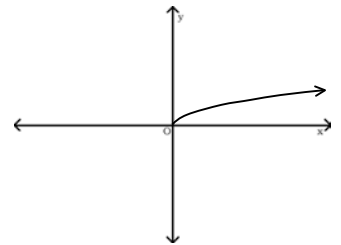
77

Families of Functions



$$y=\sqrt{x}$$

square root---
half a parabola



$$y=\sqrt{x}$$

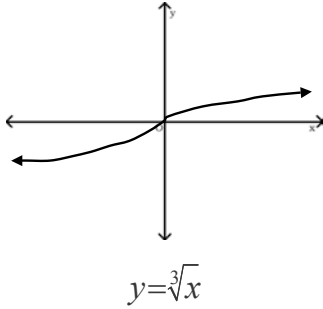


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Families of Functions



$y = \sqrt[3]{x}$
cube root---
flat 's'



$$y = \sqrt[3]{x}$$



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Families of Functions

These families move too...
but we will consider only
one move in this
presentation



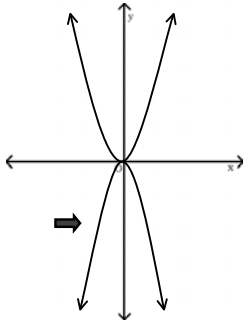
80

Families of Functions



↓
 $y = -x^2$

When a **negative**
sign is added in front
of the **function** the
graph
becomes a **reflection**
about the **x-axis**



$$y = x^2$$



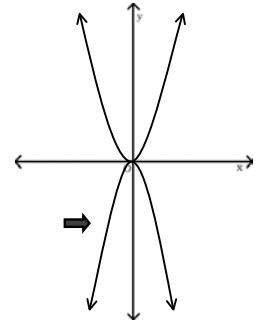
81

Families of Functions



↓
 $y = -x^2$

The positive y-values
become **negative**
values---that's how
we get a **reflection**



$$y = x^2$$



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Families of Functions

And the other families
behave the same way...



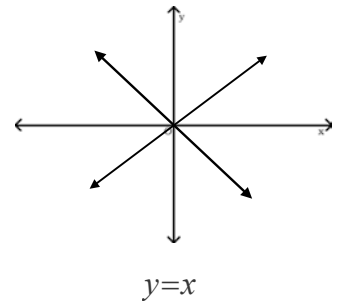
83

Families of Functions



↓
 $y = -x$
identity---
reflection

FYI:
Sometimes $y = x$
is called the
identity function
because x
doesn't change
its **identity**



$$y = x$$



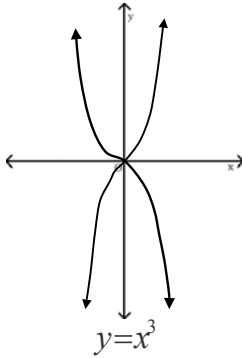
84

Families of Functions



$$y = -x^3$$

cubing
function---
reflection



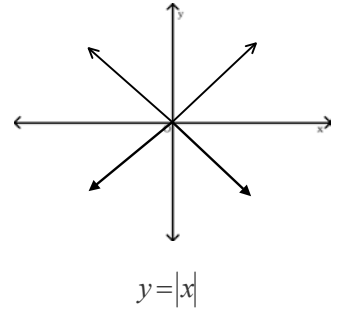
85

Families of Functions



$$y = -|x|$$

absolute
value---
reflection



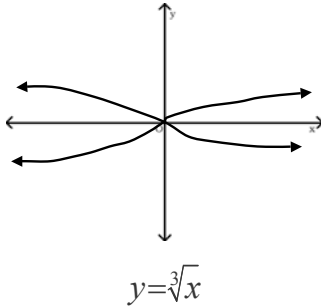
86

Families of Functions



$$y = -\sqrt[3]{x}$$

cube root
function---
reflection



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Families of Functions

Hope you've filled up that
math tool box!



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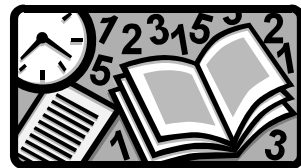
- Graphing Functions ---
without a calculator

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You can do this!



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