

⑤

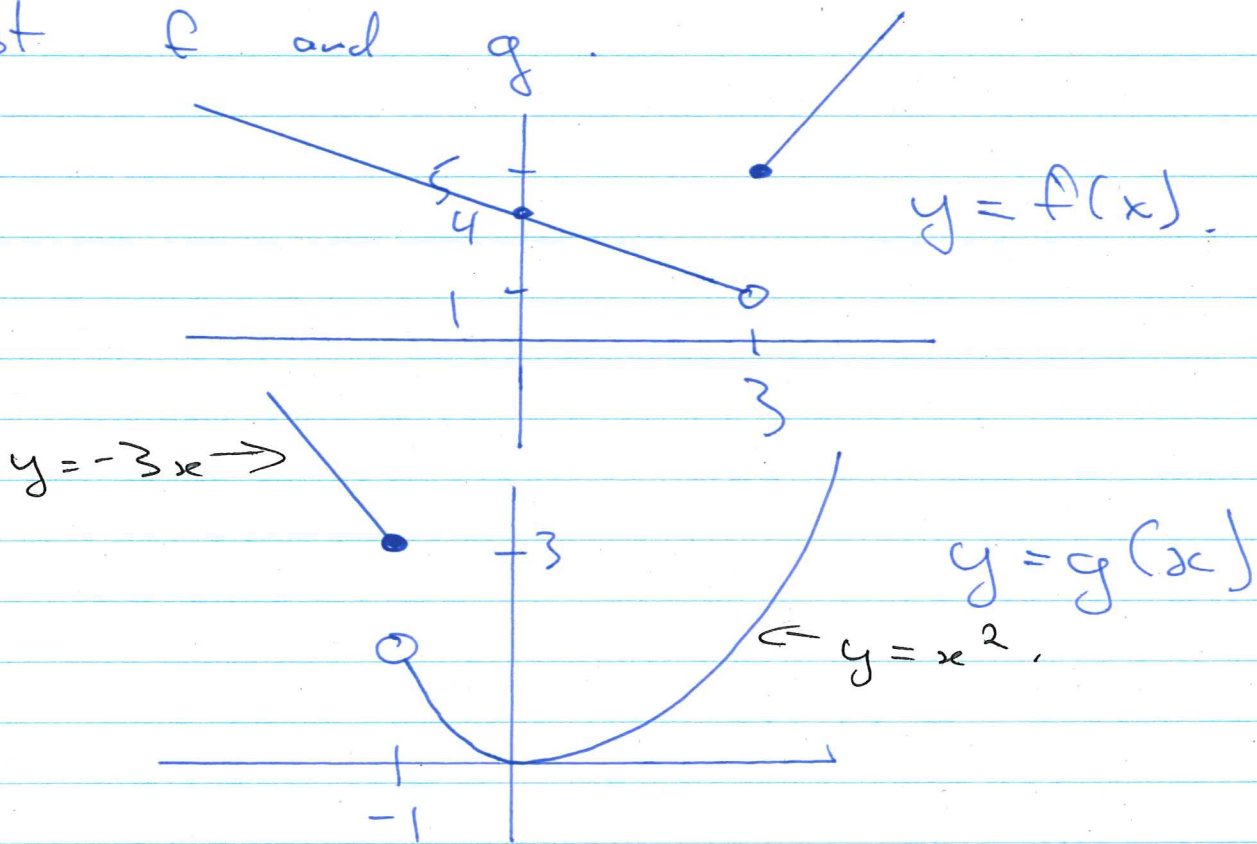
~~the old assignment.~~

Sept. 18

Let $f(x) = \begin{cases} 2x - 1, & x \geq 3 \\ -x + 4, & x < 3 \end{cases}$

$g(x) = \begin{cases} x^2, & x > -1 \\ -3x, & x \leq -1 \end{cases}$

Plot f and g .



①

Sept. 21

- HW # 1 Due. Solutions go up today.
- HW # 2 is posted. Due Monday.
- Quiz # 1 Friday.

Find $g(2)$, $g(-1)$, $g(-2)$.

$$g(2) = 2^2 = 4.$$

$$g(-1) = -3(-1) = 3.$$

$$g(-2) = -3(-2) = 6.$$

Clicker Q: Find $f(g(1))$.

A) 16 \rightarrow B) 3

C) 5 D) 7.

$$f(g(1)) = f(1) = 3.$$

Q: $f(g(-1))$? \textcircled{C} .

$$f(g(-1)) = f(3) = 5.$$

Q: $g(f(0))$. \textcircled{A} .

$$g(f(0)) = g(4) = 16.$$

2

Sept 21

More on Composition later this week.

Exponents and Exponential Functions.

Let's think about $f(x) = 2^x$.

(not a polynomial x^2, x^3)

If $x = a$ is a natural number
(1, 2, 3, 4, 5, ...)

$$2^a = \underbrace{2 \cdot 2 \cdot \dots \cdot 2}_{a \text{ times}}$$

Observe,

$$2^a \cdot 2^b = \underbrace{2 \cdot 2 \cdot \dots \cdot 2}_{a \text{ times}} \cdot \underbrace{2 \cdot 2 \cdot \dots \cdot 2}_{b \text{ times}} = 2^{a+b}$$

and

$$(2^a)^b = \underbrace{2^a \cdot 2^a \cdot \dots \cdot 2^a}_{b \text{ times}} = \underbrace{2 \cdot 2 \cdot \dots \cdot 2}_{a \text{ times}} \cdot \underbrace{2 \cdot 2 \cdot \dots \cdot 2}_{a \text{ times}} \cdot \dots \cdot \underbrace{2 \cdot 2 \cdot \dots \cdot 2}_{a \text{ times}} = 2^{ab}$$

③

What is 2^{-1} ?

$$2^{-1} = 1/2$$

$$2^{-2} = 1/2^2 = 1/4$$

$$\frac{2^a}{2^b} = 2^a 2^{-b} = 2^{a-b}$$

$$2^{1/2} = \sqrt{2}$$

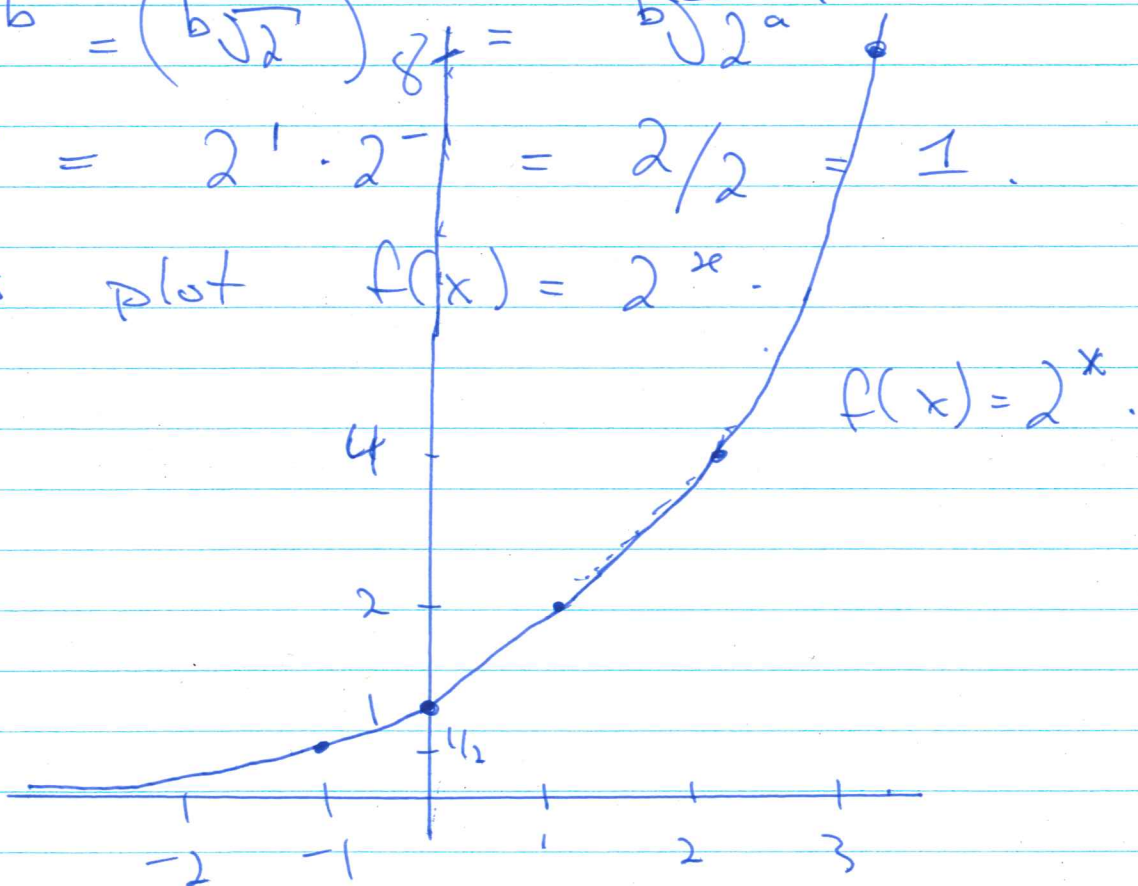
$$2^{1/3} = \sqrt[3]{2}$$

$$2^{1/a} = \sqrt[a]{2}$$

$$2^{a/b} = (\sqrt[b]{2})^a = \sqrt[b]{2^a}$$

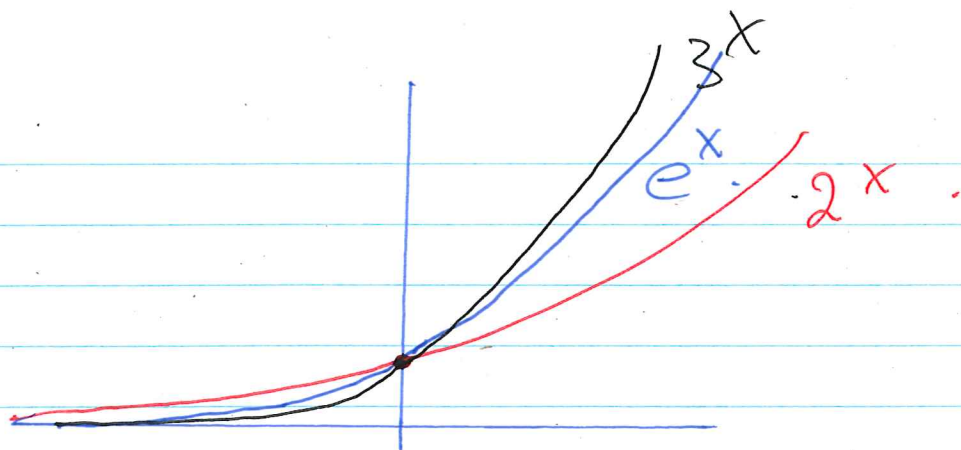
$$2^0 = 2^1 \cdot 2^{-1} = 2/2 = 1$$

Let's plot $f(x) = 2^x$.



4

Sept. 21



Now $f(x) = e^x$ is an incredibly important function.
(more on why later)

What is e ? $e = 2.71\dots$

Example: Simplify

$$\frac{(\sqrt{e} \cdot e^2)^3}{e} = \cancel{e^{1/2}} \cdot \cancel{8e^{1/2}} \cdot \cancel{13e^{1/2}}$$

$$= \frac{(e^{1/2} \cdot e^2)^3}{e} = \frac{(e^{5/2})^3}{e}$$

$$= \frac{e^{15/2}}{e}$$

$$= e^{15/2} e^{-1} = e^{13/2}$$

$$e^{1/2} \cdot e^2$$

$$= e^{1/2+2}$$

5

Sept. 21

Simplify! $\frac{e^{x^3} \cdot e^{2x} \cdot e^x}{e^3}$

aside: $e^{x^3} \stackrel{?}{=} (e^x)^3$
 $\parallel e^{3x}$
try $x=2$
 $e^{2^3} = e^8 \neq e^{3 \cdot 2} = e^6$

$$= \frac{e^{x^3 + 2x + x}}{e^3} = e^{x^3 + 2x + x - 3}$$
$$= e^{x^3 + 3x - 3}$$

Let $2^x = 8$ what is x ?

$$\Rightarrow x=3$$

What about $e^x = 2$?
We need logarithms.