Unit 4 NOTES Honors Common Core Math 2 ☆ write down! tonight's HW 23 → Packet p 13 Print next notes + packet

Day 7: Modeling Advanced Functions

Warm-Up:

1) $(a^7)(a^4) =$ a^{11} a^{7+4}

2) $(2p^3)(5p) =$ $10p^4$ $2\cdot 5p^{3+1}$

3) $(x^4y^5)^2 =$ x^8y^8 $(x^4)^2(y^5)^2 = x^{4\cdot 2}y^{5\cdot 2}$

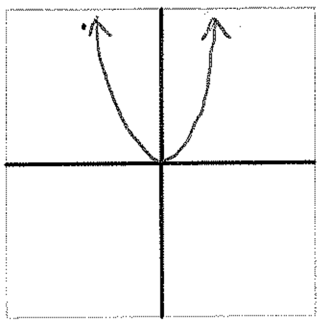
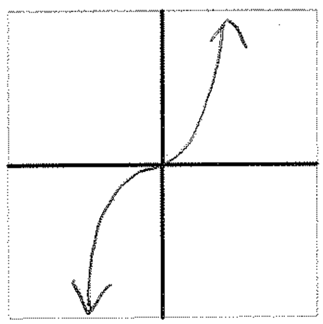
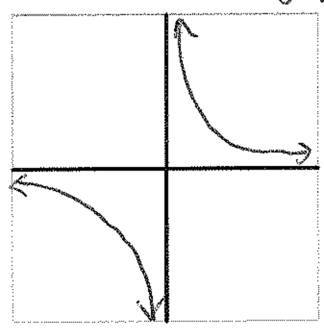
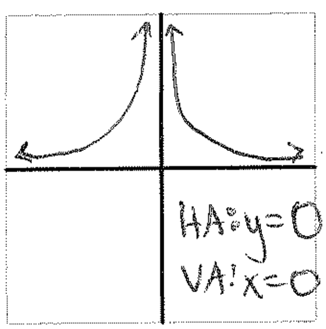
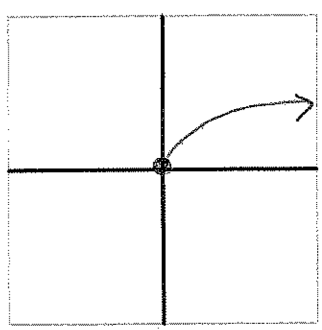
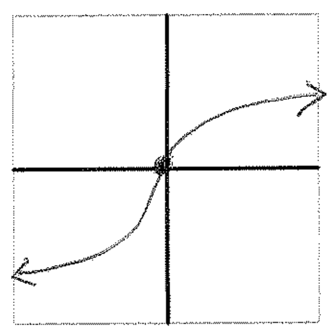
4) $(2x^3y^4)^2 =$ $4x^6y^8$ $(2)^2(x^3)^2(y^4)^2$

Modeling Power Functions

Power function $y = k \cdot x^p$

What effect will the k have? vertical stretch or compression (like with prior functions)

Special Power functions: Let's draw a reminder of their basic shapes!! ☺ → Reminder of some to know for today's quiz!

Parabola	Cubic Function	Hyperbola
$y = x^2$ 	$y = x^3$ 	$y = x^{-1}$ ↳ same as $y = \frac{1}{x}$  HA: $y=0$ VA: $x=0$
	Square Root Function	Cube Root Function
$y = x^{-2}$  HA: $y=0$ VA: $x=0$	$y = x^{1/2}$ 	$y = x^{1/3}$ 

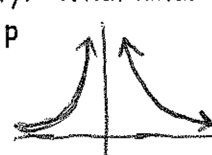
Most power functions are similar to one of these six. What functions have ~~similarity~~ symmetry? What kind?

↳ draw sketch of graphs

x^p with positive even powers of p are similar to x^2

symmetry over y-axis

x^p with negative even powers of p are similar to x^{-2}

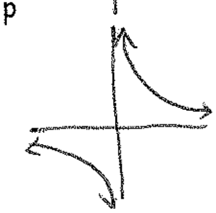


symmetry across y-axis

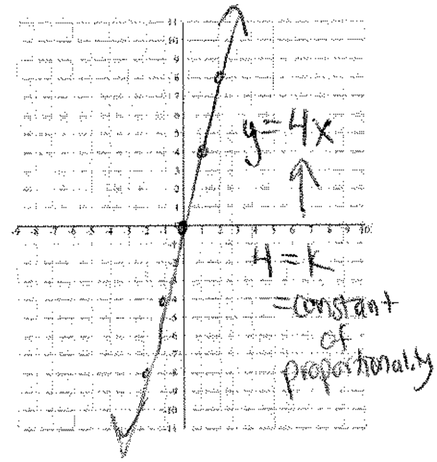
x^p with positive odd powers of p are similar to x^3

symmetry about origin (symmetric over y-axis then x-axis) or 180° rotation

x^p with negative odd powers of p are similar to x^{-1}



symmetry about origin (symmetry over y-axis and x-axis) or 180° rotation



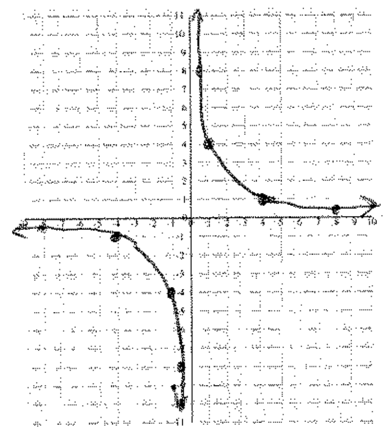
One type of power function is a direct proportion: $y = k \cdot x$

(alternatively: $k = \frac{y}{x}$), where k is a constant other than 0. k is called constant of proportionality

As x gets larger, y must also get larger, keeping k the same.

Examples: • distance = rate x time, • force = mass x acceleration

- y = 4x (graph at the right)
- paycheck = ($8 per hr)(# of hrs worked) → work more → higher paycheck



Another type of power function is an inverse proportion: $y = \frac{k}{x}$

(alternatively: $y = k \cdot x^{-1}$), where k is a constant other than 0.

As x gets larger, y must get smaller, keeping k the same.

Examples: • the time taken for a journey is inversely proportional to the speed of travel; • the time needed to dig a hole is (approximately) inversely proportional to the number of people digging.

- y = 4/x (graph at the right)
- time to bake cookies is inversely proportional to oven temperature → higher oven temp → less time to bake cookies

Say that we are told that f(1) = 7 and f(3) = 56

We can find f(x) given the data is linear: y = mx + b

We can find f(x) when the data is exponential: $y = a(b)^x$

Now we consider finding $f(x) = kx^p$ (we'll need to graph on our calculators!)

Application – Power Regression! → Type points given into calc for L1 + L2

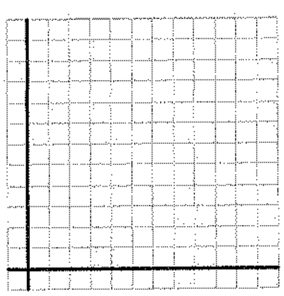
Cycling bicycle for 24 miles

Rate (miles/hr)	~~0~~	1	3	6	9	12	18	24
Time (hr)	~~X~~		8	4		2		1

omit

L1	L2
3	8
6	4
12	2
24	1

1. Graph the points.



2. Find a power function that models the data. After entering data do Stat → Calc → PwrReg PwrReg L1, L2, Y1 $\boxed{y = 24 \cdot x^{-1}}$

*Be sure to put L1, L2, Y1 at back to help do predictions!

3. Determine whether the function is direct or inverse variation. because time drops as mph increases and because negative exponent

4. Fill in the missing values in the table Do Y1(1) OR find x = 1 in table

$\boxed{(1, 24)\quad (9, 2\tfrac{2}{3})\quad (18, 1\tfrac{1}{3})}$

5. Determine the rate of cycling if a person biked for 6 hours. → $Y_2 = 6$

① 2nd y= turn on plots ② Zoom 9 ③ and intersect

$\boxed{\text{4 miles per hour}}$