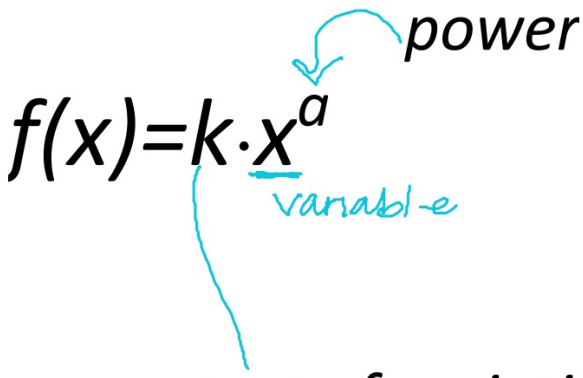
Took Unit 2 Quiz First

2.2 Power Functions with Modeling

Objective: Describe and create power functions

Power function:

FORM: $f(x)=k\cdot x^{a}$



Common Power Functions:

	Power?	Constant of variation
Circumference $C=2\pi r$	1	2π
Area of a circle $A=\pi r^2$	2	π
Force of gravity $f=mg$ ($9.8\ m/s^2$, $32\ ft/s^2$)	1	9
Boyle's Law / Higgins' Law $y=\frac{k}{w^2}$, $y=kw^{-2}$	-2	k

Practice Page 196 1-10

In Exercises 1–10, determine whether the function is a power function, given that c, g, k, and π represent constants. For those that are power functions, state the power and constant of variation.

1. $f(x) = -\frac{1}{2}x^5$

2. $f(x) = 9x^{5/3}$

3. $f(x) = 3 \cdot 2^x$

4. $f(x) = 13$

5. $E(m) = mc^2$

6. $KE(v) = \frac{1}{2}kv^5$

7. $d = \frac{1}{2}gt^2$

8. $V = \frac{4}{3}\pi r^3$

9. $I = \frac{k}{d^2}$

10. $F(a) = m \cdot a$

answers:

1. power $= 5$, constant $= -\frac{1}{2}$

2. power $= \frac{5}{3}$, constant $= 9$

3. not a power function

4. power $= 0$, constant $= 13$

5. power $= 1$, constant $= c^2$

6. power $= 5$, constant $= \frac{k}{2}$

7. power $= 2$, constant $= \frac{g}{2}$

8. power $= 3$, constant $= \frac{4\pi}{3}$

9. power $= -2$, constant $= k$

10. power $= 1$, constant $= m$

Positive powers are statements of ___Direct variation___.

$y = kx$

Negative powers are statements of ___Inverse variation___.

$y = \frac{k}{x}$

Write the statement as a power function. Use 'k' for the constant of variation if one is not given.

$y = kx$

1. The area of a rectangle with a fixed width varies directly with its length.

$A = k\ell$

2. The length of a rectangle with an area $50ft^2$ varies inversely with it's height.

$y = \frac{k}{x}$ $\quad \ell = \frac{k}{h}$

Analyzing Power Functions:

$f(x) = \sqrt[3]{x}$ or f(x)= $f(x) = x^{\frac{1}{2}}$ or f(x)= $f(x) = x^2$

Domain: all reals
Range: all reals
Continuous
Increasing for all x
Symmetric with respect to the origin (an odd function)
Not bounded above or below
No local extrema
No asymptotes

Domain: $(-\infty, 0) \cup (0, \infty)$
Range: $(0, \infty)$
Continuous on domain, discontinuous at x = 0
Increasing $(-\infty, 0)$
Decreasing $(0, \infty)$
Symmetric with respect to:
y-axis
Bounded below
No local extrema
Horizontal asymptote: y = 0,
Vertical asymptotes: x = 0

Analyzing Power Functions:

$f(x) = \sqrt[3]{x}$

$f(x) = x^{\frac{1}{2}}$

End Behavior:

limit notation

$\lim_{x \to -\infty} f(x) = -\infty$

$\lim_{x \to \infty} f(x) = \infty$

$\lim_{x \to -\infty} f(x) = 0$

$\lim_{x \to \infty} f(x) = 0$

EX

My paycheck varies directly with the # of hours I work.

If I make $480 by working 27 hours, how much will I make if I work 9.75 hours?

find formula

$P = kw$

P = paycheck

w = hrs worked

find var. constant

$P = kw$

$480 = k(27)$

$k = \frac{480}{27}$

$k = 17.77$

ans. Q

$P = 17.77w$

$P = 17.77(9.75)$

$P = \$173.33$

Ex The number of bats in a belfree is inversely proportional to the square of the # of fruit trees on the land. If there are 480 bats when 207 trees are present, determine # trees for 11,001 bats.

b = bats
t = trees

$$b = \frac{k}{t^2}$$

$$480 = \frac{k}{(207)^2}$$

$$k = 20567520$$

$$b = \frac{20567520}{t^2}$$

$$11001 = \frac{20567520}{t^2}$$

$$t^2 = \frac{20567520}{11001}$$

$$\sqrt{t^2} = \sqrt{1869.6}$$

$$t = 43.2 \text{ trees}$$