HOMEWORK: VARIATION

NAME: ______________________________ DAY 9 DUE: __________

For each verbal expression given, write the formula to represent the relationship.

a. Y varies inversely with the square of x. $y = \frac{k}{x}$

b. Z varies directly with y and inversely with x. $y = \frac{k}{x^2}$

c. Z varies directly with x and inversely with y. $z = \frac{ky}{x}$

d. Y varies jointly with x and y and inversely with z. $z = \frac{kx}{y}$

e. R is inversely proportional to s and directly proportional to the square of t.

$R = \frac{kt^2}{s}$

f. M is directly proportional to n and inversely proportional to s cubed.

$M = \frac{kn}{s^3}$

g. The power (P) generated for a translational motion varies jointly with the acting force (F) over a distance (d) achieved and inversely with the time (t) taken to perform this motion. $P = \frac{kfd}{t}$

h. The volume, *v*, of a balloon is directly proportional to the cube of the balloon's radius, *r*. $V = kr^3$

i. The time, *t*, that a plane spends on the runway varies inversely as the take-off speed. $t = k/s$

j. The radiation, *r*, from the decay of plutonium is directly proportional to the mass, *m*, of the sample tested and inversely proportional to the square of the distance, *d*, from the detector to the sample. $r = km/d^2$

k. Linear force, F, varies directly with the mass of an object, m, and directly with the acceleration of an object, a. Identify each equation that represents this situation. Circle all that apply. $F = kma$

$a = \frac{F}{mk}$ $\quad$ $ak = \frac{F}{m}$ $\quad$ $m = Fak$

$m = \frac{F}{ak}$ $\quad$ $F = kma$ $\quad$ $m = \frac{ak}{F}$

Applications:

1. The time it takes to do a job is inversely proportional to the number of workers. If 8 workers can do a job in 6 days, then 16 workers can do the same job in –

T K w

a. 1.5 days
b. 3 days
c. 6 days
d. 12 days

$T = \frac{K}{w}$

$6 = \frac{K}{8}$

$48 = K$

$T = \frac{48}{w}$

$T = \frac{48}{16}$

$\boxed{T = 3\text{ days}}$

2. A farmer pumps water from an irrigation well to water his field. The time it takes to water the field varies inversely with the rate at which the pump operates. It takes 20 hours to water the field when the pumping rate is 600 gallons per minute. If he adjusts the pump so that it pumps at a rate of 400 gallons per minute, how long will it take to water the field?

a. 12.5 hours
b. 15 hours
c. 30 hours
d. 40 hours

$T = \frac{K}{r}$

$20 = \frac{K}{600}$

$12{,}000 = K$

$T = \frac{12{,}000}{r}$

$T = \frac{12{,}000}{400}$

$\boxed{T = 30\text{ hours}}$

3. The cost, c, in cents of lighting a 100-watt bulb varies directly as the time, *t*, in hours, that the light is on. The cost of using the bulb for 1,000 hours is $0.15. Determine the cost of using the bulb for 2,400 hours. _____

$C = Kt$

$15 = K(1000)$

$0.015 = K$

$C = 0.015t$

$C = 0.015(2400)$

$\boxed{C = 36}$

4. An equation shows m is directly proportional to n and inversely proportional to s cubed. When m = 5, then n = 160 and s = 2. What is the constant of proportionality? Write your answer as a fraction.

$m = \frac{Kn}{s^3}$

$5 = \frac{K(160)}{2^3}$

$5 = \frac{160K}{8}$

$\frac{40}{160} = \frac{160K}{160}$

$\boxed{\frac{1}{4} = K}$

5. The force needed to keep a car from skidding on a curve varies directly as the weight of the car and the square of the speed and inversely as the radius of the curve. Suppose a 3,960 lb. force is required to keep a 2,200 lb. car traveling at 30 mph from skidding on a curve of radius 500 ft. How much force is required to keep a 3,000 lb. car traveling at 45 mph from skidding on a curve of radius 400 ft.?

$F = \frac{Kws^2}{r}$

$3960 = \frac{K(2200)(30)^2}{500}$

$1{,}980{,}000 = K(1{,}980{,}000)$

$1 = K$

$F = \frac{1(3000)(45)^2}{400} = \boxed{15{,}187.5\text{ lb}}$