6.4 Variation and Modeling

NOTES

Write your questions here!

As the number of rooms **increases**, the total cost of the job

As the number of rooms **doubles**, the total cost of the job

As the number of rooms is **halved**, the total cost of the job

Number of Rooms	Cost of the Job
1	$20
2	$40
3	$60
4	$80
5	$100

DIRECT VARIATION

Ex 1: Y varies directly with x. If y= -4 when x = 2, find y, when x= -6.

Ex 2: The force, F, exerted by a spring is directly proportional to the distance, d, that it is stretched. Find the constant of proportionality and the equation of variation if F = 12 pounds when d = 1/3 foot.

As the speed **increases**, the time taken

As the speed **doubles**, the time taken is

As the speed is **halved**, the time taken is

Speed, x (km/h)	Time taken, y (in hours)
20	6
30	4
40	3
60	2
120	1

INVERSE VARIATION

Ex 3: Y varies inversely with x. If y= 40 when x= 16, find x when y= -5

Ex 4: The note played by each pipe in a pipe organ is determined by the frequency of vibration of the air in the in the pipe. The fundamental frequency, F, of vibration of air in an organ pipe is inversely proportional to the length, L, of the pipe. Find the fundamental frequency of a 1.6 foot pipe if the fundamental frequency of an 8-foot pipe is 64 vibrations per second.

JOINT VARIATION

Ex 5: The volume, V, of a right circular cone is jointly proportional to the square of its radius, r, and its height, h. Find the equation of variation if a cone of height 8 inches and radius 3 inches has a volume of 24π cubic inches.

Ex 6: The frequency, f, of a vibrating guitar string is directly proportional to the square root of the tension, T, and inversely proportional to the length, L. What is the effect on the frequency if the length is doubled and the tension is quadrupled?

COMBINED VARIATION

You try!

1)

2)

3)

SUMMARY:

Now, summarize

6.4 Variation and Modeling

PRACTICE

Directions: Write the equation of variation for each situation, use k as the constant of variation.	
1) F is inversely proportional to x	2) R is jointly proportional to S and T.
3) R varies directly as m and inversely as the square of d.	4) Kinetic energy, E, is directly proportional to the square of the velocity, v and the mass m.
Directions: Write the equation of variation for each situation and solve.	
5) U varies directly as the square root of v. If u=3 when v= 4, find u when v = 10.	6) Y varies directly as the cube of x. If y = 48 when x = 4, find y when x = 8.
7) Q varies jointly as m and the square of n, and inversely as P. If Q = 2 when m = 3, n = 6, and P = 12, find Q when m = 4, n = 18, and P = 2.	8) W varies jointly as x, y and z. If w = 36 when x = 2, y = 8, and z = 12, find w when x = 1, y = 2, and z = 4.
Directions: Translate each statement into an equation using k as the constant of variation.	
9) The length of time, t, that it takes fruit to ripen is inversely proportional to the sum, T, of the average daily temperatures during the growing season.	10) The maximum safe load, L, for a horizontal beam varies jointly as its width, w, and the square of its height, h, and inversely as its length, x.

11) The number, N, of long-distance phone calls between two cities varies jointly as the populations P_1 and P_2 of the two cities, and inversely as the distance, d, between the two cities.	12) The erosive force, P, of a swiftly flowing stream is directly proportional to the sixth power of the velocity, v, of the water.
Directions: Write the equation of variation for each situation and solve.	
13) The weight, w, of an object on or above the surface of the Earth varies inversely as the distance, d, between the object and the center of the Earth. If a girl weighs 100 pounds on the surface of the Earth, how much would she weigh 400 miles above Earth's surface? Assume the radius of the Earth is 4,000 miles.	14) Ohm's Law states that the current, I, in a wire varies directly as the electromotive forces, E, and inversely as the resistance, R. If I = 22 amperes when E = 110 volts and R = 5 ohms, find I if E = 220 volts and R = 11 ohms.
15) If the amount of time, t, it takes Sully to complete one unit of Pre-Calc varies jointly as the number of sections, s, and the number of mastery checks per section, m, and inversely as the square root of the number of problems per section, p, and t= 12 when s = 3, m= 2, and p = 64, find t when s = 5, m= 2, and p = 25.	16) The electrical resistance of a wire varies directly as its length and inversely as the square of its diameter. A wire with a length of 200 inches and a diameter of one-quarter of an inch has a resistance of 20 ohms. Find the electrical resistance in a 500 inch wire with the same diameter.

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APPLICATION

1) Y varies directly with x. If y = 15 when x = -18, find y when x = 1.6.

2) If p varies directly as the square of q and inversely as the square root of r, and p = 60 when q = 6 and r = 81, find p when q = 8 and r = 144.

3) Coulomb's Law states that the force between two charges at rest, *F*, is directly proportional to the product of the charges q_1 and q_2, and inversely proportional to the square of the distance between the charges, *d*.

(a) Write the equation that represents this relationship.

(b) What effect will the following changes have on the size of the force, *F*?

-The distance between the charges is **doubled**.

-The distance between the charges is **halved**.

-One of the charges is **doubled**.

- Both charges are **doubled**.

4) Mr. Brust ask students to rate their level of interest while watching one of is videos on a 10 point scale (10 being the most interesting thing ever and 0 being ridiculously boring). The table shows the level of interest over time as Mr. Brust lectures about mathematics.

Time (minutes)	Interest Level
1	8
2	4
3	$\frac{8}{3}$
4	2
12	$\frac{2}{3}$

(a) Is the variation direct, inverse, or joint?

(b) What is the proportionality constant?

(c) What is the level of interest at half hour into a lecture?

(d) Mr. Brust decides to stop when the interest level hits 3. When should he stop?

5) Mr. Bean has devised a complex scale to determine his students' interest level. His scale goes from 0 (Brust might as well done this video) to 100 (Kelly's style). Use the following table to find the equation of variation.

Time Spent watching video, T	Times laughed out loud, L	Blank stares into space, B	Interest Level, I
20	4	2	80
24	2	1	96
18	5	4	45
30	1	10	6

a) What is the constant of proportionality?

b) What's the equation of variation?

c) What happens to the interest level if you quadruple the times laughed out loud?

d) What happens to the interest level if you double the number of blank stares into space?

e) What effect is there on the interest level if you double the laughs out loud and the blank stares into space?

REVIEW SKILLZ

Directions: Simplify. Use only positive exponents.

1) $4x^3(5x^{-6})$	2) $\frac{10y^7}{4y^4}$	3) $(2h^3)^{-2}$	4) $\left(\frac{2m^9n^{10}\cdot 2m^8n^7}{(m^8n^3)^5}\right)^3$