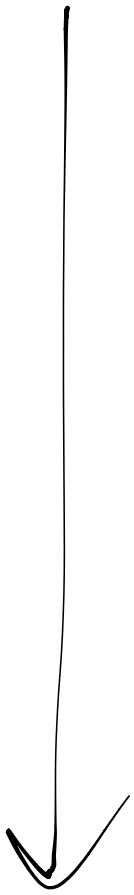
6.4 VARIATION & MODELING APP



APPLICATION

6.4 Variation and Modeling

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

$y = kx$
$15 = k(-18)$
$\frac{5}{-6} = k$

$y = kx$
$y = (-\frac{5}{6})(1.6)$
$y = -\frac{8}{3}$

$y = -\frac{4}{3}$

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.

$p = \frac{kq^2}{\sqrt{r}}$
$60 = \frac{k(6)^2}{\sqrt{81}}$
$60 = \frac{36k}{9}$

$60 = 4k$
$15 = k$

$p = \frac{kq^2}{\sqrt{r}}$
$p = \frac{(15)(8)^2}{\sqrt{144}}$
$p = \frac{15(64)}{12}$

$p = \frac{5(64)}{4}$
$p = 5(16)$
$p = 80$

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.

$F = \frac{Kq_1q_2}{d^2}$

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

-The distance between the charges is **doubled**. $F = \frac{Kq_1q_2}{(2d)^2} = \frac{Kq_1q_2}{4d^2}$ ∴ The force is reduced by Factor of ¼

-The distance between the charges is **halved**. $F = \frac{Kq_1q_2}{(\frac{1}{2}d)^2} = \frac{Kq_1q_2}{\frac{1}{4}d^2} = \frac{4Kq_1q_2}{d^2}$ ∴ The force is increased by Factor of 4

-One of the charges is **doubled**. $F = \frac{K(2q_1)q_2}{d^2}$ ∴ The force is increased by factor of 2

- **Both** charges are **doubled**. $F = \frac{K(2q_1)(2q_2)}{d^2} = \frac{4Kq_1q_2}{d^2}$ ∴ The force is increased by factor of 4

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? INVERSE

(b) What is the proportionality constant?

$I = \frac{K}{t}$ $8 = \frac{K}{1}$

$8 = K$

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

$I = \frac{8}{t}$ $I = \frac{8}{30} = \frac{4}{15}$

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

$I = \frac{8}{t}$

$3 = \frac{8}{t}$

$t3 = 8$

$t = 8/3$ minutes

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?

2

$I = \frac{KTL}{B}$

$80 = \frac{K(20)(4)}{2}$

$80 = K\,40$

$2 = K$

b) What's the equation of variation?

$I = \frac{2TL}{B}$

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

It will quadruple

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

It will be reduced by $\frac{1}{2}$

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

There will be no net effect

REVIEW SKILLZ

Directions: Simplify. Use only positive exponents.

1) $4x^3(5x^{-6})$

$= 20x^{-3}$

$= \frac{20}{x^3}$

2) $\frac{10y^7}{4y^4} = \frac{5y^3}{4}$

3) $(2h^3)^{-2}$

$= \left(\frac{1}{2h^3}\right)^2$

$= \frac{1}{4h^6}$

4) $\left(\frac{2m^9n^{10}\cdot 2m^8n^7}{(m^8n^3)^5}\right)^3$

$= \left(\frac{4m^{17}n^{17}}{m^{40}n^{15}}\right)^3$

$= \left(\frac{4n^2}{m^{23}}\right)^3$

$= \frac{64n^6}{m^{69}}$