

## 3.7 Modeling Using Variation

Note Title

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### Direct Variation

The statements

"y varies directly as x" and

"y is directly proportional to x"

both mean

$$y = k \cdot x \text{ for some nonzero constant } k$$

The number  $k$  is called the  
constant of variation

- ⓐ The amount you get paid varies directly with the length of time you work. If you work for 12 hours you get paid \$72. How much will you get paid if you work 15 hrs?

$$p = k \cdot t$$

$$\text{when } t = 12, p = 72$$

$$72 = k \cdot 12$$

$$6 = k$$

$$p = 6t$$

So when  $t = 15$

$$p = 6 \cdot 15$$

$$p = 90$$

when you work for 15 hrs  
you get paid \$90.

The statements

"y varies directly as the  $n^{\text{th}}$  power of x"

"y is directly proportional to the  $n^{\text{th}}$  power of x"

both mean

$$y = k \cdot x^n \text{ for some nonzero constant } k$$

ex) A person's weight varies directly with the square of their height.

$$w = k \cdot h^2$$

Inverse Variation

The statements

"y varies inversely as x" and

"y is inversely proportional to x"

both mean

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

for some nonzero constant k

(ex) The temperature of your food varies inversely with the minutes it's been sitting on the table. After 10 min it's  $80^\circ$ . What's the temp after 20 min?

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

$$80 = \frac{K}{10}$$

$$800 = K$$

$$T = \frac{800}{m}$$

When  $m = 20$

$$T = \frac{800}{20} = 40$$

## Combined Variation

(ex) The amount that a student likes a teacher varies directly with their grade and inversely with the amount of homework assigned.

$$L = \frac{K \cdot g}{h}$$

② The amount that a student likes a teacher varies directly with their grade and age and inversely with the amount of homework assigned.

$$L = \frac{K \cdot g \cdot a}{h}$$

A 30 year old student with a .95 who is assigned 5 hrs. of homework likes the teacher at a 12.

How much does a 35 year old with a .87 who is assigned 5 hrs of homework like the teacher?

$$12 = \frac{K \cdot .95 \cdot 30}{5} \Rightarrow K \approx 2.105$$

$$L = \frac{2.105 \cdot .87 \cdot 35}{5} \approx \boxed{12.82}$$

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