

Chapter 5.1

Variation – Direct Variation, Inverse Variation and Joint Variation

Sometimes the equation that relates two or more variables can be described in words by the idea of “variation”. There are three types.

Type of variation	Math Statement	English Statement	Example
Direct Variation		“y is directly proportional to x”	If the quantity doubles, the cost doubles. Cost=Price*Quantity
Inverse Variation		“y is inversely proportional to x”	If the Distance is fixed and the Time increases, the Rate must decrease Rate = Distance/Time
Exponential		“y grows exponentially in x”	Every time x increases by 1, Y is multiplied by “a”.
Joint Variation		“z is directly proportional to x and inversely proportional to y”	Doubling ‘x’ makes ‘z’ double, while doubling ‘y’ makes ‘z’ cut in half.

Direct Variation;

How are Distance and Rate Related?

Suppose you drive at 50mph for 300 miles.

Your friend drives twice as fast, how far does he go?

Find an equation and find the constant ‘k’.

$$D = k \cdot R$$

Inverse Variation;

How are Rate and Time Related?

Suppose you drive a certain distance at 60 mph and it takes 10 hours.

Your Friend takes twice as long, how fast did he go?

Find an equation and find the constant 'k'.

$$R = \frac{k}{T}$$

The Area of a Circle varies directly with the Square of its radius.

Set up a variation equation with 'A' and 'r'.

If the Area of a certain circle is 314 square inches and its radius is 10 inches.

Find the "constant of proportionality" 'k'.

Now you have another circle with radius 7 inches. What is its area?

The volume of a cylinder is directly proportional to its height and the square of its radius. Find a formula with 'V', 'r' and 'h'.

What happens to volume if height triples?

What happens to volume if radius doubles?

Find Constant of proportionality if $R=1$, $H = 10$ and $V=31 \frac{1}{2}$.

The force of gravity between two objects depends on three things,
The mass of the first 'M',
The mass of the second, 'm' and
the distance between them 'd'.

Force varies directly with the mass of each object and inversely with Square of the distance between them.

Find a Variation Equation for these.

If the Force between two objects is 15 N, what is the force if the mass of One object increases by 50%?

What is the Force is the distance between them is cut in half?

Hooke's law says the distance a spring will stretch is proportional to the mass hanging on the spring.
If a 4-kg mass stretches 10 cm, then how far will a 7-kg mass stretch?

What about 2-kg?

http://en.wikipedia.org/wiki/Hooke's_law

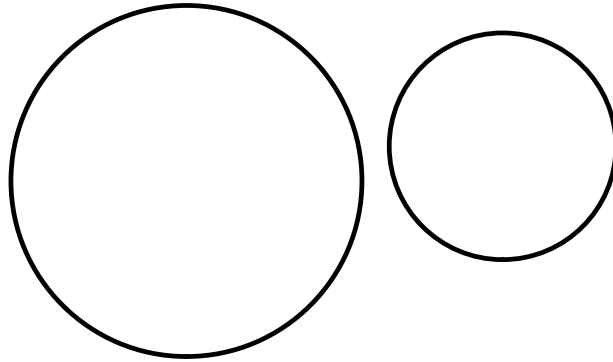
Sec. 6.2 Area and ArcLength of a Circular Sector

Area of a circle varies directly as "the square of its radius"

Circumference of a circle varies directly as the radius

What is the constant of proportionality?

Radius of one circle is 50% larger than another...
The circumference of the smaller one is 12 inches.
What is the circumference of the larger?



Define the following

- angle (two rays meeting at common vertex)
- vertex (endpoint of the two rays)
- degrees are measure of angle
- acute angle
- Right angle
- Obtuse angle
- Straight angle
- pair of complementary angles (add to 90)
- pair of supplementary angles (add to 180)
- Central angle is angle whose vertex is center of circle
- Arc on boundary of circle is "subtended" by the central angle.

Questions:

If the Radius of a circle is 5 inches, and the angle is 360 degrees.

What is the length of this circular arc?

What is the area of the sector?

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Questions:

If the Radius of a circle is 5 inches, and the angle is 90 degrees.

What is the length of this circular arc?

What is the area of the sector?

How are "Area", "radius" and "Angle" related?
What is the constant of Proportionality?

What about "circumference" , Radius and Angle?
What is the constant of Proportionality?

Pattern:

$$\frac{\theta}{360} = \frac{Area_s}{Area_c} = \frac{Arclength}{Circumference}$$

Another Formula $s = 2\pi r \left(\frac{\theta}{360} \right)$

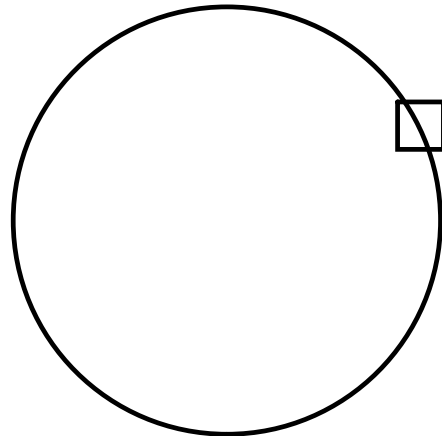
$$A = \pi r^2 \left(\frac{\theta}{360} \right)$$

Problems: Suppose a circular sector has area 14 square inches and the entire circle has area 84 square inches.

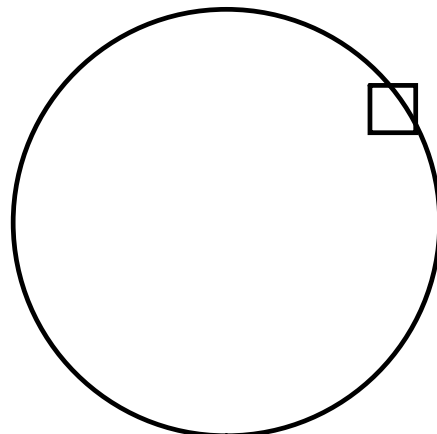
What is the measure of the central angle?

Problems: Suppose a ferris wheel has a radius of 25 feet.
As people are unloading, it rotates 20 degrees to put the next
car in position for people to get out.

How far does your car move each time?



Problems: Suppose a ferris wheel has a radius of 25 feet.
When the ferris wheel is running, it rotates at 1 revolution every 3 minutes?
How fast (in feet per minute) are you moving?



How fast is that in Miles Per Hour?

Problems: How far is it from Delaware straight South to the Equator?

Delaware	40.3 North	83.1 West
Chillicothe	39.2 North	83.2 West
Tallahassee	30.2 North	83.0 West

Diameter of Earth 7899.83 miles

Circumference of Earth 24860.2 miles

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