

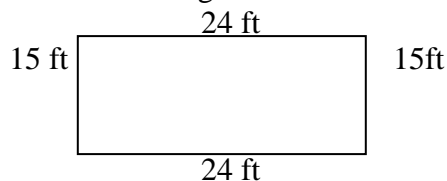
Section 2.2
Variables and
Formulas

Variables and Formulas

DEFINITIONS & BASICS

- 1) **Variables:** These symbols, being letters, actually represent numbers, but the numbers can change from time to time, or vary. Thus they are called variables.

Example: Tell me how far you would be walking around this rectangle.

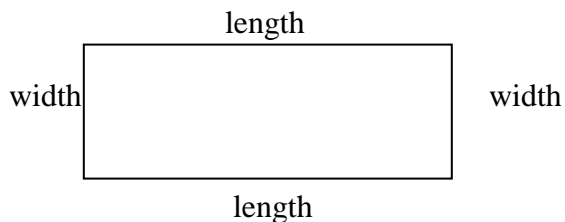


It appears that to get all the way around it, we simply add up the numbers on each side until we get all the way around.

$$24+15+24+15 = 78.$$

So if you walked around a 24ft X 15ft rectangle, you would have completed a walk of 78 ft. I bet we could come up with the **pattern** for how we would do this all of the time.

Well, first of all, we just pick general terms for the sides of the rectangle:



Then we get something like this:

$$\text{Distance around the rectangle} = \text{length} + \text{width} + \text{length} + \text{width}$$

Let's try and use some abbreviations. First, "**perimeter**" means "around measure". Substitute it in:

$$\text{Perimeter} = \text{length} + \text{width} + \text{length} + \text{width}$$

Let's go a bit more with just using the first letters of the words:

$$P = l + w + l + w$$

Notice now how **each letter stands for a number** that we could use. The number can change from time to time. This pattern that we have created to describe all cases is called a **formula**.

- 2) **Formula:** These are patterns in the form of equations and variables, often with numbers, which solve for something we want to know, like the perimeter equation before, or like:

Area of a rectangle: $A = B \times H$

Volume of a Sphere: $V = \frac{4}{3}\pi r^3$

Pythagorean Theorem: $a^2 + b^2 = c^2$

Through the same process we can come up with many formulas to use. Though it has all been made up before, there is much to gain from knowing where a formula comes from and how to make them up on your own. I will show you on a couple of them.

Distance, rate

If you were traveling at 40mph for 2 hours, how far would you have traveled? Well, most of you would be able to say 80 mi. How did you come up with that? Multiplication:

$$(40)(2) = 80$$

$$(\text{rate of speed}) \cdot (\text{time}) = \text{distance}$$

or in other words:

$$rt = d$$

where r is the rate
 t is the time
 d is the distance

Percentage

If you bought something for \$5.50 and there was an 8% sales tax, you would need to find 8% of \$5.50 to find out how much tax you were being charged.

$$.44 = .08(5.50)$$

$$\text{Amount of Tax} = (\text{interest rate}) \cdot (\text{Purchase amount})$$

or in other words:

$$T = rP$$

Where T is tax
 r is rate of tax
 P is the purchase amount.

Interest

This formula is a summary of what we did in the last section with interest. If you invested a principal amount of \$500 at 9% interest for three years, the amount in your account at the end of three years would be given by the formula:

$$A = 500(1.09)^3 = \$647.51$$

$$A = P(1 + r)^Y$$

where A is the Amount in your account at the end
 P is the principal amount (starting amount)
 r is the interest rate
 Y is the number of years that it is invested.

Temperature Conversion

Most of us know that there is a difference between Celsius and Fahrenheit degrees, but not everyone knows how to get from one to the other. The relationship is given by:

$$C = \frac{5}{9}(F - 32)$$

where F is the degrees in Fahrenheit
 C is the degree in Celsius

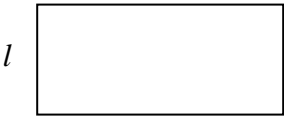
Money

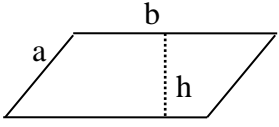
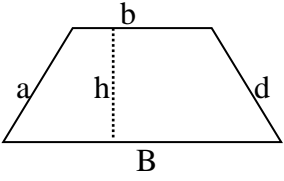
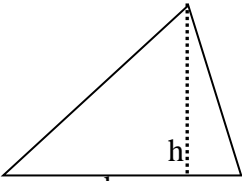
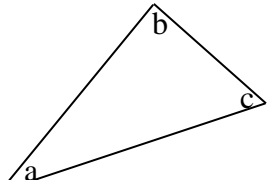
If you have a pile of quarters and dimes, each quarter is worth 25¢ (or \$.25) and each dime is worth 10¢ (\$.10), then the value of the pile of coins would be:

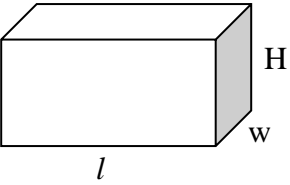
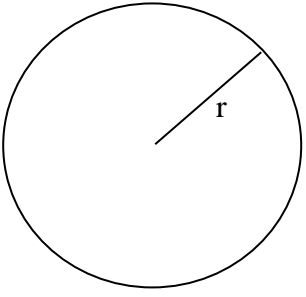
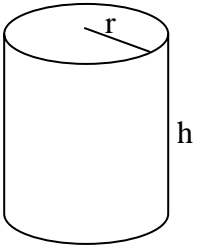
$$V = .25q + .10d$$

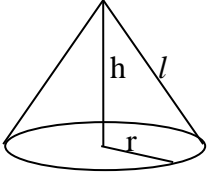
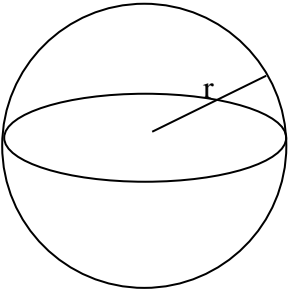
where V is the Total Value of money
 q is the number of quarters
 d is the number of dimes

- 3) **Common Geometric Formulas:** Now that you understand the idea, these are some basic geometric formulas that you need to know:

 <p style="text-align: center;">w Rectangle</p>	$P = 2l + 2w$ $A = lw$	<p>P is the perimeter <i>l</i> is the length w is the width A is the Area</p>
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 <p>Parallelogram</p>	$P = 2a + 2b$ $A = bh$	<p>P is the perimeter a is a side length b is the other side length A is the Area h is the height</p>
 <p>Trapezoid</p>	$P = b+a+B+d$ $A = \frac{1}{2}h(B+b)$	<p>P is perimeter b is the shorter base B is the longer base a is a leg d is a leg A is the Area h is the height</p>
 <p>Triangle</p>	$P = s_1+s_2+s_3$ $A = \frac{1}{2}bh$	<p>P is the perimeter s is a side A is the Area b is the base h is the height</p>
 <p>Triangle</p>	$a + b + c = 180^\circ$	<p>a is one angle b is another angle c is another angle</p>

 <p>Rectangular Solid</p>	$SA = 2lw + 2wh + 2lh$ $V = lwh$	<p>SA is the Surface Area</p> <p><i>l</i> is the length</p> <p><i>w</i> is the width</p> <p>h is the height</p> <p>V is volume</p>
 <p>Circle</p>	$C = 2\pi r$ $A = \pi r^2$	<p>C is the Circumference or Perimeter</p> <p>π is a number, about 3.14159 . . . it has a button on your calculator</p> <p>r is the radius of the circle</p> <p>A is the area inside the circle.</p>
 <p>Cylinder</p>	$LSA = 2\pi rh$ $SA = 2\pi rh + 2\pi r^2$ $V = \pi r^2 h$	<p>LSA is Lateral Surface Area or area just on the sides</p> <p>π is a number, about 3.14159 . . . it has a button on your calculator</p> <p>r is the radius of the circle</p> <p>h is the height</p> <p>SA is total surface area</p> <p>V is Volume</p>

 <p>Cone</p>	$LSA = \pi r l$ $SA = \pi r^2 + \pi r l$ $V = \frac{1}{3} \pi r^2 h$	<p>LSA is Lateral Surface Area or the area just on the sides</p> <p>π is a number, about 3.14159 . . . it has a button on your calculator</p> <p>r is the radius of the circle</p> <p>h is the height l is the slant height</p> <p>SA is total surface area</p>
 <p>Sphere</p>	$SA = 4\pi r^2$ $V = \frac{4}{3} \pi r^3$	<p>SA is the surface area</p> <p>π is a number, about 3.14159 . . . it has a button on your calculator</p> <p>r is the radius</p> <p>V is the Volume</p>