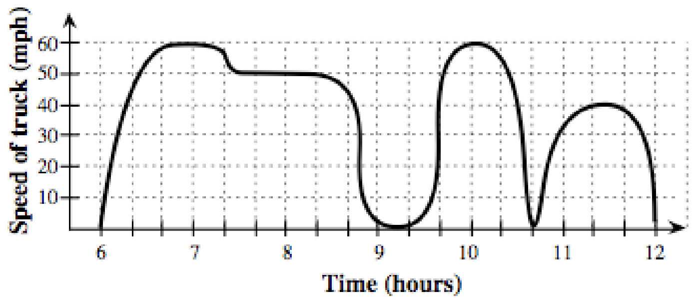
The situations you will encounter in calculus at first seem like problems you have seen before. You already have many mathematical methods to *approximate* the solutions. During this calculus course, you will develop tools to find precise solutions.

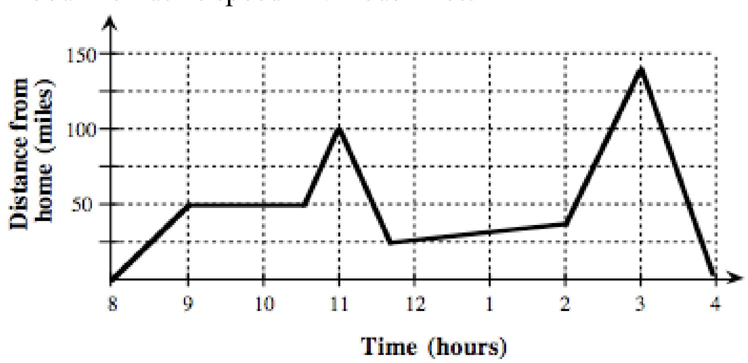
As both an overview and introduction, this chapter is a good opportunity to reinforce the qualities of good teamwork: mutual respect, self-reliance, good communication and fair division of labor. The ability to work well as a team will increase the effectiveness of future learning.

1-1. FREEWAY FATALITIES
Some people think that the number of freeway accidents can be reduced if cars and trucks were prevented from speeding. In fact, in some countries, trucks are legally required to have special devices (called tachographs) on their wheels which records the truck's speed at all times. Lesson 1.1.1 Resource Page

a. A graph showing the speed of a truck in miles per hour over a 6-hour period is shown below. Estimate the total distance the truck has traveled during this time. Then explain how you could get more accurate estimates using the same graph.



b. The graph below shows the distance traveled by a *different* truck over an 8-hour time period. Make and justify as many statements as you can about the truck's speed at various times.



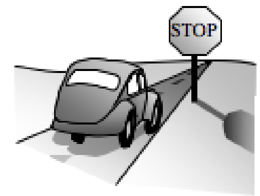
c. Look back at your work in both graphs. The answers you got related to the*geometry* of each graph.

For instance, in the first graph, confirm that the truck traveled about 27 miles from 6:00 a.m. to 6:40 a.m., and 53 miles from 7 a.m. to 8 a.m. What do 27 and 53 represent geometrically in the first graph?

In the second graph, confirm that from 8 a.m. to 9 a.m., the speed of the truck is 50 mph. What does this 50 represent geometrically about the second graph?

Review & Preview

MATH NOTES

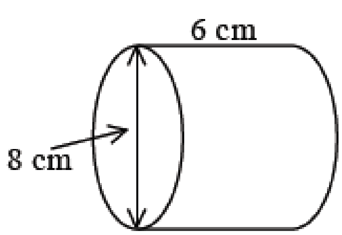


Volumes of Standard Solids

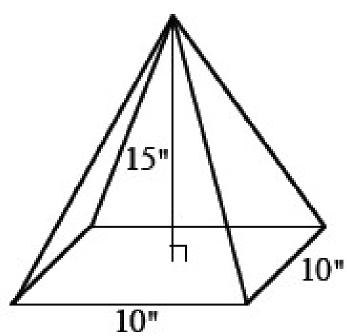
The following formulas are useful for finding the volumes of typical geometric figures. Note the B is the *base area* of the solid.

- Prism: $V = Bh$
- Cylinder: $V = \pi r^2 h$
- Sphere: $V = \frac{4}{3}\pi r^3$
- Pyramid: $V = \frac{1}{3}Bh$
- Cone: $V = \frac{1}{3}\pi r^2 h$

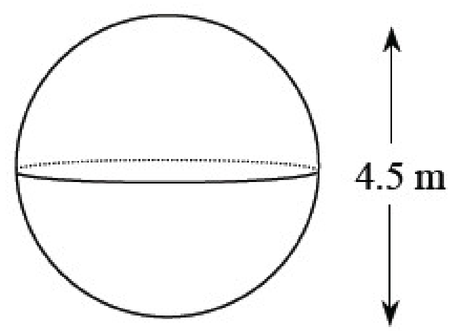
1-2. Find the volume of each of the following solids. Help (Html5)⇔Help (Java)



a.

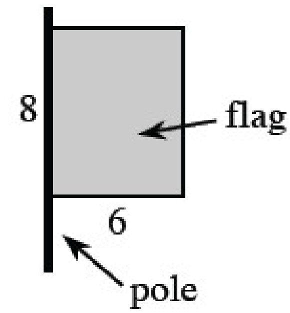


b.



c.

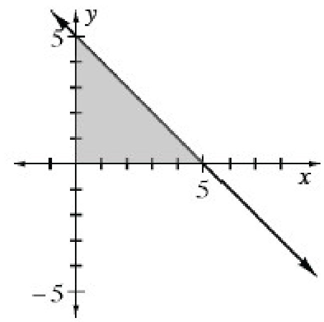
1-3. We will define a "flag" as a geometric area attached to a line segment (its "pole"). An example is shown below. Help (Html5)⇔Help (Java)



a. Imagine rotating the flag about its pole and describe the resulting three-dimensional figure. Draw a picture of this figure on your paper.

b. Find the volume of the rotated flag.

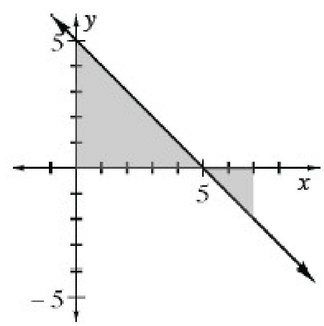
1-4. Examine the graph the function $f(x) = 5 - x$ at right. Help (Html5)⇔Help (Java)



a. Find the area of the shaded region using geometry.

> We will use the notation $A(f, 0 \leq x \leq 5)$ to represent "The area between the function and the x-axis" over the interval from $x = 0$ to $x = 5$.

b. Notice that the line dips below the x-axis when $x > 5$. We will consider the area*below* the x -axis as negative. Find $A(f, 0 \leq x \leq 7)$.



c. Find k if $A(f, 0 \leq x \leq k) = 0$. Show how you obtained your solution clearly and completely.

1-5. Quickly sketch the function $g(x) = \sqrt{16 - x^2}$. Help (Html5)⇔Help (Java)

a. State the domain and range of $g(x)$.

b. Use geometry to find $A(g, 0 \leq x \leq 4)$.

c. Find $A(g, -4 \leq x \leq 4)$.

d. What is the relationship between the answers of (b) and (c)?

1-6. A car travels 50 miles per hour for 2 hours and 40 miles per hour for 1 hour. Help (Html5)⇔Help (Java)

a. Sketch a graph of velocity vs. time. Label the axes with units.

b. Fill out the table below for the distance vs. time.

Time	0.5	1	1.5	2	2.5	3
Distance						

c. Graph the function of distance vs. time. Label the axes with units.

1-7. TRANSLATING FUNCTIONS   Help (Html5)⇔Help (Java)

a. Graph the function $y=\frac{2}{3}x^2$. On the same set of axes graph a translation of the function that is shifted one unit to the right and five units down. Write the equation of the translated function.

b. Does the same strategy work for $y=\frac{2}{3}x$? Write an equation that will shift $y=\frac{2}{3}x$ one unit to the right and five units down.

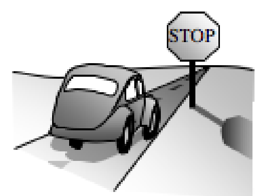
c. Compare the graphs of and $y=-\frac{1}{2}x$ and $y=-\frac{1}{2}(x+2)+3$. Describe their similarities and differences.

d. Explain how you know that the graph of $y = −9(x + 1) − 6$ goes through the point $(−1, −6)$ and has a slope of $−9$.

e. Sketch the graph of $y = 5(x − 2) − 1$ quickly.

1-8. Find the equation of the line through the point $(−5, −2)$ with a slope of $−3$ using the method developed in problem 1-7. Refer to the Math Notes box below for help.   Help (Html5)⇔Help (Java)

MATH NOTES



Point-Slope Form of a Line

When given the slope of a line and one point on the line, we can find the equation of the line using the **point-slope form.** This is the translation of the origin of the line $y = mx$ to the point (h,k). The equation is of the form:

$$y = m(x − h) + k$$

Sometimes, you will see the point-slope form of a line also written as: $y − k = m(x − h)$, which is an equivalent expression.

1-9. Now you know *two* general equations used to write the equation of a line:

$$y = mx + b \text{ and } y = m(x − h) + k$$

Under what circumstances is each equation easier to use? For parts (a) through (c) below, determine which method is best with the given information. Then, write the equation for the line.   Help (Html5)⇔Help (Java)

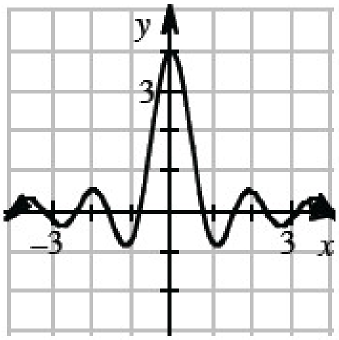
a. $m=-\frac{2}{5}$ and through $(−6, 2)$

b. $m = 3$ and $b = −6$

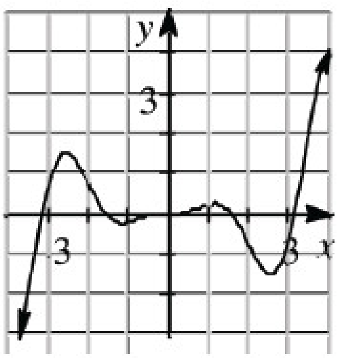
c. Through $(2, 8)$ and $(1,3)$.

1-10. For each function $f(x)$ sketched below, sketch $f(-x)$ and compare it with $f(x)$. Then describe its symmetry. Help (Html5)⇔Help (Java)

a.



b.



c. EVEN AND ODD FUNCTIONS--INFORMALLY

A function that is symmetric with respect to the y-axis, like that in part (a) above, is called an **even** function. A function that is symmetric with respect to the origin, such as that in part (b), is called an **odd** function.

Sketch examples of even and odd functions. Include how you can test whether a function is even or odd. Then list some famous even/odd functions from your parent graphs, and the symmetries associated with even and odd functions.