

## Math Review

### *Functions and data tables*

1. Make a data table showing the values of  $x$  and  $y$  for the following functions, for each integer value of  $x$  from  $-3$  to  $+3$ . (Hint: if necessary, start by algebraically manipulating the equation into a form that allows you to easily find the value of  $y$ ). What are the slopes and  $y$ -intercepts of equations (a) and (b)? What type of function is equation (c)?
  - a.  $y = 3x$
  - b.  $2x + 3y = 6$
  - c.  $y + 3 = x^2$

### *Graphing*

2. Graph the functions from Problem 1. You may use the same set of axes to plot all three functions. Label the  $x$  and  $y$  axes, and show the  $x$  and  $y$  scale that you have chosen. (You can use graph paper, or just draw the graph on plain paper that you have drawn axes and hatch marks to show the scale).

### *Geometrical areas and volumes*

3. Calculate the following:
  - a. The area of a square 5.0 feet on a side.
  - b. The circumference and area of a circle with a radius of 7.00 km.
  - c. The area of a triangle with a height of 30 m and a base of 5.0 m.
  - d. The surface area and volume of cube 3.0 inches on each edge.
  - e. The radius and volume of a sphere with a *circumference* of 31.2 cm.

*Exponential and logarithm functions*

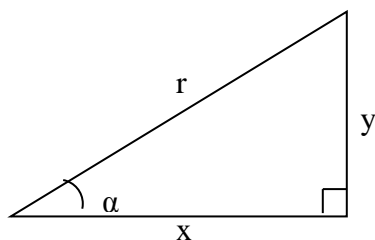
4. Simplify the following expressions completely using the laws of exponents.
  - a.  $3^x \cdot 3^{-x}$
  - b.  $(4^x)^y$
  - c.  $3^3 \div 3^5$
  - d.  $e^a \cdot e^b \div e^c$
  - e.  $10^{bx} \cdot 10^{-cx}$
  
5. Simplify the following expressions completely using the properties of logarithms. (Note: “log x” written without a subscript is shorthand for  $\log_{10} x$ , “ln” written without a subscript is short for  $\log_e x$ .)
  - a.  $\log (m/n)$
  - b.  $\log (m \cdot n)$
  - c.  $\log m^n$
  - d.  $\ln e^{-n}$
  - e.  $\log_e (m \cdot n)$
  
6. Evaluate the following without using a calculator. (Hint:  $\log 2 \approx 0.30$ ,  $\log 3 \approx 0.48$ ,  $\log 7 \approx 0.85$ ,  $\ln 2 \approx 0.69$ ,  $\ln 10 \approx 2.3$ )
  - a.  $\log_3 27 =$
  - b.  $\log_8 2 =$
  - c.  $\log 6 =$
  - d.  $\log 700 =$
  - e.  $\log 3,000 =$
  - f.  $\ln 8 =$
  - g.  $\ln 0.1 =$
  
7. What is the doubling time (or halving time) if the exponential growth (or decay) rate is the following:
  - a. 3.2% per year
  - b. 0.45/s
  - c. 0.0038/min
  
8. A population of Canadian Geese grows exponentially at a rate of 10% per year.
  - a. In about how many years will the population double?
  - b. In about how many years will the population have doubled 20 times?
  - c. About how many times the original population will the geese population be after 20 doublings? (Hint: Use the fact that  $2^{10} = 1024 \approx 10^3$  to calculate the population).

*Trigonometry*

9. Convert the following angles from degrees to radians and vice versa:

- a.  $180^\circ$
- b.  $270^\circ$
- c.  $4\pi/3$
- d.  $-\pi$

10. For the right triangle below, write the formulas for  $\sin \alpha$ ,  $\cos \alpha$ , and  $\tan \alpha$  in terms of the lengths of the sides  $x$ ,  $y$ , and  $r$ .



11. Write the formula for  $\tan \alpha$  in terms of  $\sin \alpha$  and  $\cos \alpha$ .

12. If angle  $\alpha$  equals  $60^\circ$  and side  $r$  has a length of 5.00 miles, what are the lengths of sides  $x$  and  $y$ , respectively? [Hint:  $\cos 30^\circ = 0.500$ ,  $\sin 60^\circ = 0.866$ .] Check your answer using the Pythagorean Theorem.