

**MT 1800**  
**Calculus 1 - Test 1**

Name \_\_\_\_\_

1. The monthly charge for a waste collection service is \$112 for 24 kg of waste and is \$500 for 800 kg of waste.

(a) Find a linear formula for the cost,  $C$ , of waste collection as a function of the number of kilograms of waste,  $w$ .

(b) What is the slope of the line found in part (a)? Interpret your answer in terms of the cost of waste collection

(c) What is the vertical intercept of the line found in part (a)? Interpret your answer in terms of the cost of waste collection?

2. The following table defines three functions.

$x$	$f(x)$	$g(x)$	$h(x)$
-2	14	32	36
-1	20	48	33
0	21	72	30
1	22	108	27
2	19	162	24

(a) Which of the functions in the table could be linear? Explain your reasoning.

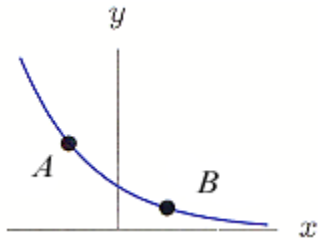
(b) Which of the functions could be exponential? Explain your reasoning.

3. An air freshener starts with 16 grams and evaporates. In each of the following cases, write a formula for the quantity,  $Q$  grams, of air freshener remaining  $t$  days after the start.

(a) The decrease is 2 grams a day.

(b) The decrease is 15% a day. (Note: Use the general exponential function.)

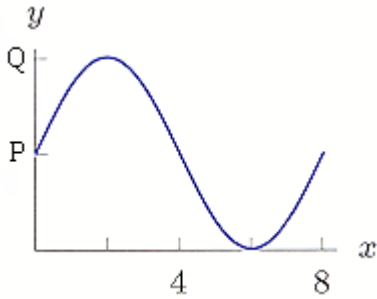
4. Give a possible formula for the function below. Let  $A = (-1, 20)$  and  $B = (1, 5)$ .



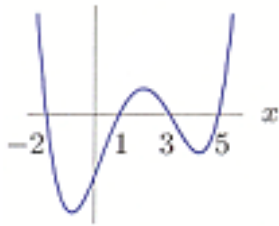
5. A tree of height  $y$  meters has, on average,  $B$  branches, where  $B = y - 6$ . Each branch has, on average,  $n$  leaves where  $n = 3B^2 - B$ . Find the average number of leaves of a tree as a function of height.

6. The cost of producing  $q$  articles is given by the function  $C = f(q) = 155 + 7q$ .
- Find the formula for the inverse function.
  
  
  
  
  
  
  
  
  
  
  - Explain in practical terms what the inverse function tells you.
7. At time  $t$  hours after taking the cough suppressant hydrocodone bitartrate, the amount,  $A$ , in mg, remaining in the body is given by  $A = 10(0.82)^t$ .
- What was the initial amount taken?
  
  
  
  
  
  - What percent of the drug leaves the body each hour?
  
  
  
  
  
  - How much of the drug is left in the body 6 hours after the dose is administered?
  
  
  
  
  
  - How long is it until only 1 mg of the drug remains in the body?

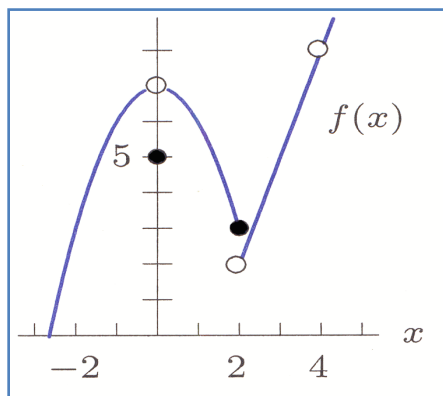
8. Find a possible formula for the following graph of a trigonometric function. Let  $P = 2$  and  $Q = 4$ .



9. Give a possible formula for the graph below. Assume the graph crosses the  $x$ -axis at exactly  $-2$ ,  $1$ ,  $3$ , and  $5$ . Let  $k$  be an arbitrary constant with  $k > 0$ .



10. Use the graph below to give approximate values for the following limits (if they exist).  
(Note: For limits that exist, assume that they are approaching integers. If a limit does not exist, write DNE.)



- (a)  $\lim_{x \rightarrow 0} f(x)$   
 (b)  $\lim_{x \rightarrow 4} f(x)$   
 (c)  $\lim_{x \rightarrow 2} f(x)$   
 (d)  $\lim_{x \rightarrow -2} f(x)$

**Extra credit for correct mathematical language and notation:**

Mathematics is a language, and use of proper wording and notation is essential to clear communication. This checklist gives you an opportunity to review your work and make sure you have used correct mathematical language and notation.

5 checks: +2

4 checks: +1

- \_\_\_ 1. Equal sign used properly. The expressions on both sides of this symbol must indeed be equal to each other.
  
- \_\_\_ 2. Correct use of variable. Be sure that you are consistent in your use of variables. State your answers in terms of the variables given in the problem. For example, if the problem asks you to find a model  $P(t)$ , for some population, your model must use the variables  $P$  and  $t$ .
  
- \_\_\_ 3. Correct limit notation.  $\lim_{x \rightarrow a} f(x) = L$ . Limits must have an argument, a subscript, and an answer.
  
- NA 4. Correct notation for antiderivatives (integrals):  $\int f(x)dx = \text{answer}$ . Correct notation begins with the antiderivative symbol, has an expression in the middle, and ends with  $dx$ ,  $dt$ , etc. (according to the variable—see item 2 above). The answer does not include the symbol.
  
- NA 5. Answers to antiderivatives end with  $+C$ . This is essential for solving IVP's correctly.
  
- \_\_\_ 6. Correct use of fractions. It must be clear what expression is on the top and what expression is on the bottom. Use horizontal fraction bar or parentheses were appropriate.
  
- \_\_\_ 7. Written descriptions should be given in complete sentences.
  
- \_\_\_ 8. Your work must be neat. Neatness always counts.
  
- \_\_\_ 9. Use parentheses where necessary. For example,  $4t - 5$  and  $4(t - 5)$  are not equal.