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1. Complete the following definition of the derivative function f '(x).

Given any function, f(x), the derivative function, f '(x) is defined as

f '(x) =

2. Write the four steps that are used to find the derivative function, according to the above definition.

Step 1: _____

Step 2: _____

Step 3: _____

Step 4: _____

Use the four-step method outlined above to find the derivative of each of the following functions. Show your steps neatly organized.

3. $f(x) = x^2$

4. $f(x) = 3x^2 - 2x + 5$

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5. Complete each of the following 'rules of differentiation'.

a. If $f(x) = x^n$, then $f'(x) =$ _____.

b. If $f(x) = c$, then $f'(x) =$ _____.

c. If $f(x) = cg(x)$, then $f'(x) =$ _____.

d. If $f(x) = g(x) + h(x)$, then $f'(x) =$ _____.

Use the 'rules of differentiation' to find the derivative of each of the following functions.

6. $f(x) = 3x^2 + 5x - 6$

$f'(x) =$ _____

7. $f(x) = x^3 + 2x^2 - 7x - 1$

$f'(x) =$ _____

8. $f(x) = x^4 + x^3 + x^2 + x + 1$

$f'(x) =$ _____

9. $f(x) = (x^2 + 2x + 3)(x^2 - 2x + 3)$

$f'(x) =$ _____

10. $f(x) = (x + 3)(x^2 - 3x + 9)$

$f'(x) =$ _____

11. $f(x) = (x - 3)^3$

$f'(x) =$ _____

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Find all stationary points for each of the following functions. Use values of f(x), the function itself, to classify each as a maximum, a minimum, or neither.
Show your work and your answers neatly organized on your work paper.

12. $y = f(x) = x^4 - 8x^2 + 5$

13. $y = f(x) = x^3 + 6x^2 - 2$

Find all stationary points for each of the following functions. Use values of f '(x), the slope, to classify each as a maximum, a minimum, or neither.
Show your work and your answers neatly organized on your work paper.

14. $y = f(x) = 2x^3 - 30x^2 + 150x - 200$

15. $y = f(x) = -4x^3 + 21x^2 + 24x$

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Solve the following problems. Show your work and your solutions neatly organized.

16. A steel ball is propelled upward in such a way that its distance above the ground, s, (measured in feet) after t seconds is given by the function

$$s = f(t) = 288 + 48t - 16t^2, \text{ where } 0 \leq t \leq 6.$$

Answer the following questions.

a. Write a function for the velocity of the ball in terms of t.

$$v = \_\_\_\_\_$$

b. Find the maximum height reached by the ball and the time required for it to reach that height.

c. Describe the position and the velocity of the ball when t = 0 s.

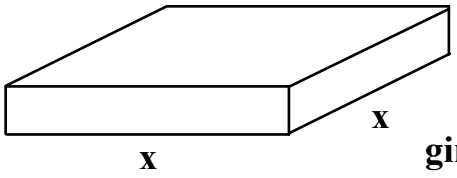
d. Describe the position and the velocity of the ball when t = 1 s.

e. Describe the position and the velocity of the ball when t = 6 s.

Solve the following problems. Show your work and your solutions neatly organized.

17. A square piece of metal measuring 6 inches on each side is to be made into a box without a top by cutting equal squares out of the corners and turning up the edges. What are the dimensions of the box with maximum volume?

18. The sum of the length and the girth of a package mailed first-class must not exceed 72 inches, the girth being defined as the shortest distance around the package. A package is a rectangular box with a square base whose width is greater than its height. (See the diagram below.) What is the maximum volume of the package?



girth = 2x + 2y

length = x