1 True/False

For each of the following questions respond true if the statement is true and false if the statement is false. If your response is false give a counter example or explain why.

1. Differentiable functions are continuous.

2. The derivative is defined at every point in a function's domain.

3. The second derivative of sin(x) is equal to the 3 derivative of cos(x).

4. If the left and right limits exist at a point the function has a limit at that point.

5. The derivative is only defined for functions.

2 Free response

For the following questions evaluate the limit or state why it does not exist:

1.

$$\lim_{x \to \pi^+} \frac{x^2 + 4x - \sin(x)}{x - \pi}$$

2.

$$\lim_{x \to 3} \frac{x - \sin(x - 3) - 3}{x - 3}$$

3.

$$\lim_{x \to -2^-} x\sqrt{x + 2}$$

4.

$$\lim_{x \to -\infty} \frac{\sqrt{4-x}}{x+1}$$

Use the limit definition of the derivative for problems 5,6:

5. Find $f'(x)$ if $f(x) = x^2 + x + 3$

6. Find $g'(4)$ if $g(x) = \frac{x-4}{x}$

Evaluate the following derivatives:

7. find $D_x[f(x)]$ if $f(x) = x^2 \sin(x^2)$

8. find $\frac{dg}{dx}$ if $g(x) = \frac{\cos(x)+x^3}{\tan x}$

9. Find $h^{(3)}(t)$ if $h(t) = x^4 + 3\cos(x)$

10. Find $\frac{d^{50}}{dx^{50}}p(x)$ if $p(x) = \sin(x) + \cos(x) + x^{45}$

Using implicit differentiation find dy/dx

11. $y = \sqrt{x^2 + \sin(x)}$

12. $x = \sin(y^2) + 2x^3$

Set up and solve the following related rates problem

13. An airplane is flying west at 500 miles per hour and passes over a train travelling south at 100 miles per hour. How quickly will they be separating from one another after they have travelled for two and a half hours?

14. A 6 foot long ladder is propped up against a wall. It starts to slide down the wall at a speed of 1 foot per second. How quickly is the base of the ladder sliding away from the wall when the top of the ladder is 3 feet from the ground?