

(12pts) **Problem 1**

Evaluate the following limits

$$(a) \quad \lim_{x \rightarrow 0} \frac{\sqrt{9+x} - 3}{x} \qquad (b) \quad \lim_{x \rightarrow 0^+} \frac{1 - \cos x}{x^2}$$

(9pts) **Problem 2**

Consider the function

$$g(x) = \frac{x^2 - 1}{|x| - 1}.$$

Evaluate the following limits

(a) $\lim_{x \rightarrow 1^-} g(x)$ (b) $\lim_{x \rightarrow 1^+} g(x)$

(c) $\lim_{x \rightarrow 1} g(x)$

(9pts) **Problem 3**

For what value (s) of the constant a is the function f continuous at $x = 0$.

$$f(x) = \begin{cases} \frac{x^2 + 2}{x + 1}, & \text{if } x < 0 \\ a - 1, & \text{if } x \geq 0 \end{cases}$$

(10pts)**Problem 4**

Determine whether or not $f(x) = \begin{cases} x^2, & x < 1 \\ 3, & x = 1 \\ 2x + 1, & x > 1 \end{cases}$ is continuous at $x = 1$. If not, determine whether the discontinuity is a removable discontinuity, a jump discontinuity, or neither.

(16pts) **Problem 5**

Find $\frac{dy}{dx}$ for

(a) $y = (1 + 2x)(1 + \sin x)$

(b) $y = \ln(3x - 1)$

(c) $y = e^{x^2+3x-\frac{1}{x}}$

(d) $y = \frac{4x+3}{5x-1}$

(12pts) **Problem 6**

Use the second derivative test to find the local extrema of

$$f(x) = 6x^5 + 33x^4 - 30x^3 + 100.$$

(6pts)**Problem 7**

If $G(x) = f(g(x))$ where $f(-1) = 4$, $f'(-1) = 3$, $f'(-2) = 3$, $g(2) = -2$, $g'(2) = \frac{1}{2}$. $G'(2)$

is equal to

(a) 9

(b) -6

(c) $\frac{3}{2}$

(d) -4

(e) $-\frac{5}{2}$

(6pts)**Problem 8**

An equation of the tangent line to the graph of

$$y = \tan x + 2 \sin x + 2$$

at $x = 0$ is equal to

(a) $y = \frac{x}{3} + 2$

(b) $y = -x + 2$

(c) $y = 3x + 2$

(d) $y = 2x + 3$

(e) $y = 6x + 2$

(5pts)**Problem 9**

The slope of the tangent line to the graph of

$$x^2 + y^2 = 9$$

at the point $(2, \sqrt{5})$ is equal to

(a) $\frac{-2\sqrt{5}}{5}$

(b) $\frac{-2\sqrt{5}}{9}$

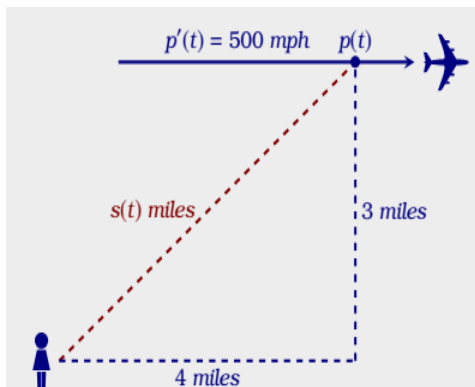
(c) $\frac{\sqrt{5}}{2}$

(d) $2\sqrt{5}$

(e) $9\sqrt{5}$

(5pts)**Problem 10**

A plane is flying directly away from you at 500 mph at an altitude of 3 miles. How fast is the plane's distance from you increasing at the moment when the plane is flying over a point on the ground 4 miles from you?



(a) $s'(t) = 500mph$

(b) $s'(t) = 400mph$

(c) $s'(t) = 300mph$

(d) $s'(t) = 100mph$

(e) $s'(t) = 200mph$

(5pts) **Problem 11**

Suppose that the amount of money in a bank account after t years is given by

$$A(t) = 2000 - 10te^{5 - \frac{t^2}{8}}$$

The absolute minimum amount of money in the account during the first 10 years.(i.e. on the interval $[0, 10]$) is equal to:

(a) 1999.94

(b) 200

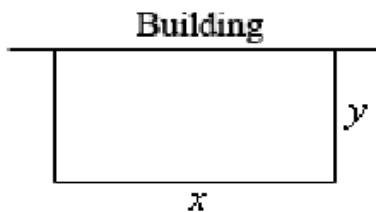
(c) 199.66

(d) 190.6

(e) 1990

(5pts) **Problem 12**

We need to enclose a field with a fence. We have 500 feet of fencing material and a building is on one side of the field and so won't need any fencing.



The largest possible area is equal to

(a) $A = 2225$

(b) $A = 5503$

(c) $A = 42730$

(d) $A = 31250$

(e) $A = 25000$