(12*pts*) **Problem 1**
Evaluate the following limits

$$(a) \quad \lim_{x \to -1} \frac{x^2 - 4}{3x - 2} \qquad (b) \quad \lim_{x \to -\infty} \frac{3\,|x^3| + x + 1}{1 + 2x^3}$$

$$(c) \quad \lim_{x \to 0} \frac{\sqrt{2 + x} - \sqrt{2}}{x} \qquad (d) \quad \lim_{x \to 0^+} \frac{\ln x^2}{x^2}$$

(9*pts*) **Problem 2**
Consider the function

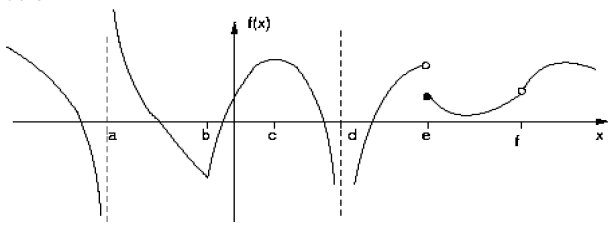
$$g(x) = \frac{x^2 - 1}{|x| - 1}.$$

Evaluate the following limits
(*a*) $\lim_{x \to 1^-} g(x)$ (*b*) $\lim_{x \to 1^+} g(x)$
(*c*) $\lim_{x \to 1} g(x)$

(9*pts*) **Problem 3**
For what value (s) of the constant a is the function f continuous at $x = 3$.

$$f(x) = \begin{cases} 5ax^2 + x, & \text{if } x < 3 \\ x - 1, & \text{if } x \geq 3 \end{cases}$$

(10*pts*)**Problem 4**
Consider the function $f(x)$ graphed below.



(a) Find the points where the function is discontinuous and classify the discontinuities as removable, jump or infinite.
(b) Find the point(s) where the function is NOT differentiable.

(16pts) **Problem 5**

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

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

(b) $y = \ln \sqrt[3]{3x-1}$

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

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

(12*pts*) **Problem 6**
Find the critical numbers and the local extrema of

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

(6*pts*)**Problem 7**

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

is equal to

$$(a) \quad 9$$

$$(b) \quad -6$$

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

$$(d) \quad -4$$

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

(6*pts*)**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

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

$$(b) \quad y = -x + 2$$

$$(c) \quad y = 3x + 2$$

$$(d) \quad y = 2x + 3$$

$$(e) \quad y = 6x + 2$$

(5*pts*)**Problem 9**
The slope of the tangent line to the graph of

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

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

(a) $9\sqrt{5}$

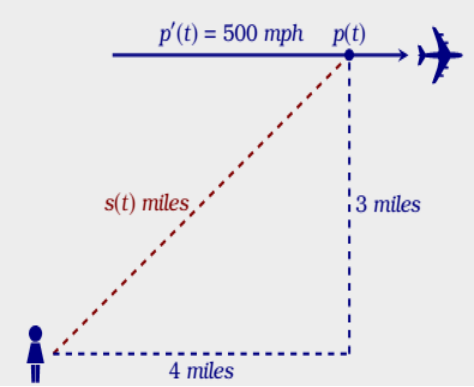
(b) $\dfrac{-2\sqrt{5}}{9}$

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

(d) $2\sqrt{5}$

(e) $\dfrac{-2\sqrt{5}}{5}$

(5*pts*)**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 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

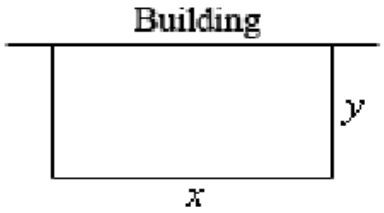
(b) 199.66

(c) 200

(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) $A = 31250$

(b) $A = 5503$

(c) $A = 42730$

(d) $A = 2225$

(e) $A = 25000$