

**MTH 151**  
**Exam 3**  
**Spring 2010**

Show all work in a neat and organized fashion. Clearly indicate your answers.  
100 points possible.

1. (10 pts.) Submit your take home problem.
2. (10 pts.) Find the following limits exactly. Provide all major algebraic/symbolic steps to justify that your answer is correct. Find the *exact* answer, with radical signs if necessary, not a decimal approximation.

(a)

$$\lim_{x \rightarrow +\infty} \frac{6x^3 - 4x^2 - 1}{11x^3 - 7x + 4}$$

(b)

$$\lim_{x \rightarrow +\infty} \frac{\sqrt{3x^4 + 15x + 7}}{8x^2 + 9}$$

3. (10 pts.) Use Newton's method to find the root of the given equation to the best accuracy your calculator will display. Use the specified initial approximation  $x_1$ , and show your values for  $x_2$ ,  $x_3$ ,  $x_4$ , and so on, until the algorithm stabilizes.

$$3x^3 + 2x + 4 = 0, \quad x_1 = -1$$

Recall that

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$$

and

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}.$$

4. (10 pts.) A particle is moving with the given data. Find the position function  $s(t)$  for the particle.

$$a(t) = 12t - 4, \quad s(1) = 5, \quad v(1) = 10$$

5. (10 pts.) The graph of the velocity function of a particle is shown in the attached figure on the final page. Sketch the graph of the position function.

6. (10 pts.) Use your NUMANTI (numerical antiderivative) program to do this problem. Let  $v(t) = \sqrt{1+t^6}$ . Assume the initial position at time  $t = 0$  is  $s = 5$ . Use a step size of 0.2.

(a) Find the position at time  $t = 3$ .

(b) Find the net change in position from time  $t = 0$  to time  $t = 3$ .

7. Find each indefinite integral.

(a) (5 pts.)  $\int \frac{x^3 - 5}{\sqrt{x}} dx$

(b) (5 pts.)  $\int x^3(9 + 3x^4)^6 dx$

(c) (5 pts.)  $\int x^{11} \sqrt{16 + x^6} dx$

(d) (5 pts.)  $\int \frac{1}{x^4} \sqrt{9 + \frac{1}{x^3}} dx$

(e) (5 pts.)  $\int \sec^2 x \tan^5 x dx$

(f) (5 pts.)  $\int \sin 4x \cos^5 4x dx$

8. (10 pts.) **Set up** the following problem but **do not solve it**.

(“Set up” means write down the function to be maximized and get it as a function of one variable only. Be sure to say or to show in a sketch what your variable represents.)

An isosceles triangle has base 80 and height 100. Find the dimensions of the rectangle of largest area that can be inscribed in this triangle if one side of the rectangle lies on the base of the triangle.