

## Math 242 Test 1, Friday 21 September

Name:

Last 4 digits of SSN:

Show all work clearly. No work means no credit. The points are:  
ex1: 7, ex2: 9, ex3: 9, ex4: 10, ex5: 10 plus 5 point for the writing.

**Exercise 1** The skid marks made by an automobile indicated that its brakes were fully applied for a distance of 75 m before it came to a stop. The car in question is known to have a ***constant deceleration*** of  $20 \text{ m/s}^2$  under these conditions.

1. Find the expression of the motion of the automobile when the brakes start (take  $v_0$  for initial velocity).
2. How fast - in km/h - was the car traveling when the brakes were first applied ?

**Exercise 2** We are considering the following differential equation:

$$3xy' + y = 12x.$$

1. On which intervals does there exist a unique solution?
2. Solve the equation with the initial value  $y(1) = 0$ .

**Exercise 3** A cake is removed from an oven at  $210^{\circ}\text{F}$  and left to cool at room temperature, which is  $70^{\circ}\text{F}$ . After 30 min the temperature of the cake is  $140^{\circ}\text{F}$ .

1. Using the Newton's law of cooling, determine the temperature of the cake at a time  $t$  (we take  $t = 0$  when the cake is removed from the oven).

2. When will the temperature of cake be  $100^{\circ}\text{F}$  (you can use that  $\frac{\ln(14/3)}{\ln(2)} \approx 2.22$ ) ?

**Exercise 4** We consider the following differential equation:

$$(\cos x + \ln y)dx + \left(\frac{x}{y} + e^y\right)dy = 0.$$

1. Show that this equation is exact.
2. Then solve this differential equation.

**Exercise 5** We consider the following differential equation:

$$x(x + y)y' + y(3x + y) = 0.$$

1. Write this differential equation as a homogeneous one.

2. Then solve this differential equation (you can use a formula of type  $\int \frac{f'}{f} = \dots$ )