

**Name:** \_\_\_\_\_

**Student ID:** \_\_\_\_\_

**WINTER 2011 FINAL EXAM**  
**Calculus for Electronics Engineering Technology**  
**Dawson College: Department of Mathematics**  
**Date: May 24th 2011, 9:30am to 12:30pm**  
**Course Code: 201-NYA-05 Section 7**

**Question 1.** *(10 marks (1 mark each))*

Differentiate the following functions with respect to  $x$ .

(a)  $f(x)$

**Question 2.** (6 marks)

Find the function  $y = f(x)$  satisfying the following properties:

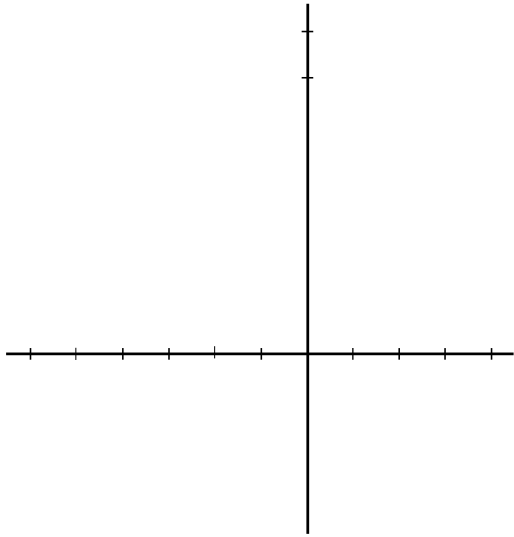
- $f''(x) = \frac{3}{x^2} + 2e^{1-x}$
- The slope of the tangent line to the curve  $y = f(x)$  at  $x = 1$  is 2
- $y = f(x)$  passes through the point  $(1, 0)$

**Question 3.** (10 marks)

Use the graph of  $y = f(x)$

**Question 4.** (4 marks)

Use the graph of the function  $y = f(x)$  and its tangent line at  $x = -2$  pictured below to find the value of  $f'(-2)$ .



**Question 6.** (5 marks)

The charging voltage for a  $0.1\mu F$  capacitor is given by  $v = 0.25t^2 - 2t + 5$  volts.

**Question 7.** (5 marks)

Sketch the curves  $y = \sin x$ ,  $y = 0.5$ ,  $x = 0$  and  $x = \frac{\pi}{2}$  and find the area between them.

**Question 8.** *(10 marks (2.5 marks each))*



**Question 9.** (10 marks)

Sketch the graph of  $f(x) = x^2(x - 2)^2$ . Find and clearly identify on the sketch the following:

(a) The  $x$  and  $y$  intercepts

(b) The behavior of the function as  $x$  tends to  $\pm\infty$

(c) The intervals where  $f(x)$  is increasing/decreasing and any relative maxima or minima.

(d) The intervals where  $f(x)$  is concave up/down and any points of inflection

SKETCH OF  $f(x) = x^2(x - 2)^2$

**Question 10.** *15 marks (3 marks each)*

Integrate the following.

(a)

$$\frac{-2 \cos(4x)}{\sin 4x} dx$$

(b)

$$(4x^3 - 6x)(4x^4 - 12x^2)^{-5} dx$$

(c)

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**Question 11.** (6 marks (2 marks each))

Find the value of the constant  $a$  in each of the following equations.

(a)

$$\frac{7}{3x^6} dx = ax^{-5} + C$$

(b)

$$-6x^3 dx = ax^4 + C$$

(c)

$$5x^{\frac{-3}{2}} dx = \frac{a}{\sqrt{x}} + C$$

**Question 12.** (5 marks)

A discharged ( $V_c = 0$  at  $t = 0$ ) 4mF capacitor is to be charged by a current of  $i = 25e^{1-0.75t}$  mA. Find the capacitor voltage ( $V_c$ ) at  $t = 135$ ms.

**Question 13.** (6 marks)

Find the equation of the line tangent to the curve  $xy^3 = e^x + y$  at the point  $(0, -1)$ .

**Question 14.** (4 marks)

Use the **limit definition of**  $\lim_{x \rightarrow 0} \frac{e^x - 1}{x} = 1$ .

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