# Math 151

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|---|---|---|
| **Show Your Work!** | Feb. 12, 2018 | Name ______________________ |
| Good Luck! | Test #2 A | (please print) |

1. Calculate these 7 derivatives (Do **not** simplify once all derivatives are calculated.)

   **Show work** & **circle your final answers**.

   (a) $\frac{d}{dt}\left( \ln\left(t^2 + e^{3t}\right) \right) =$

*( 5 each )*

   (b) $D(\ \sin^3(2x^5 + 7)) =$

   (c) $D(\ e^{5x} \cdot \tan(2x+3)\ ) =$

   (d) If $f(x) = \sqrt{e^{Ax} + \sec(Bx)}$ (A and B are constants), then f '(x) =

   (e) $\frac{d}{dt}\left(\frac{4^t + 3}{\cos(5t)}\right) =$

   (f) If $g(x) = 5x^2 + e^{7x} + \frac{4}{x^3} + 9$ then $g''(x) =$

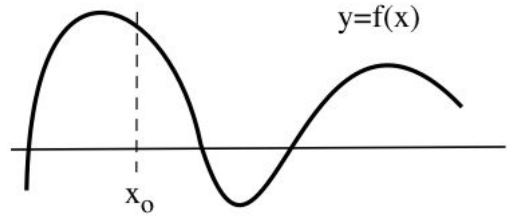
2. The units of D are days, F units are feet. **Give the units** for the following:

*(2)* (a) $\frac{dD}{dF}$ ____________ *(2)* (b) $\frac{d^2D}{dF^2}$ ____________

3. The figure shows the graph of f(x) and the location of $x_0$.

Find and LABEL the locations of $x_1$ and $x_2$ obtained by using Newton's Method..

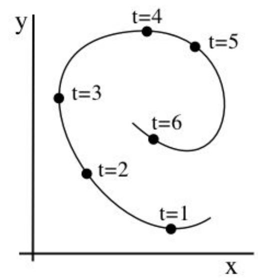
*(4)*




4. $f(x) = x^3 - 5x + 6$. If we start with $x_0 = 1$,

then using Newton's Method $x_1 =$____________ , $x_2 =$ ____________ (2 decimal places)

*(4)*




5. (a) See the figure at the right, and use that information to fill in the blanks in the table with POS, NEG, ZERO or UND when t=2.

*(8)*

| dx/dt | dy/dt | dy/dx |
|---|---|---|
| | | |

(b) When t=3, $\frac{dy}{dt}$ is POS, NEG, ZERO or UND

6. The location of an robot at time t minutes is x(t) = 5t + 2sin(t), $y(t) = t^2 - 3\cos(t)$ meters. (RADIAN mode!)

(Round answers to TWO decimal places.)

*(2)* (a) When t = 2 minutes, the location of the robot is. ( , )

*(6)* (b) When t = 2 minutes, $\frac{dx}{dt} =$ __________ $\frac{dy}{dt} =$ __________ $\frac{dy}{dx} =$ __________

*(3)* (c) When t = 2 minutes, the SPEED of the robot is ____________________

7. A bug is crawling back and forth along the x-axis (marked in cm) , and the bug's location at time t minutes is $h(t) = t^3 - 6t^2 + 70$ cm . **(Be sure to include units with your answers.)**

*(2)* (a) Where is the bug at 2 minutes after starting? ______________

*(3)* (b) What is the bug's velocity after 2 minutes? ________________

*(3)* (c) When will the bug change directions? ____________________

*(3)* (d) How far will the bug crawl during the first 6 minutes? _______________

*(3)* (e) When is the bug's acceleration equal to 0? _______________

9. The number of fish in the lake at time t days is $F(t) = 300 + 90\cos(t) + 50 \cdot e^{-0.3t}$ .

*(1)* (a) How many fish are present at time t = 3? _________________

*(4)* (b) How fast is the fish population changing when t = 3 ? ______________________

10. (a) $f(x) = \sqrt{x}$ . Find the linear approximation L(x) of f(x) when x = 81. L(x) = ____________________

(b) Use your result in part (a) to approximate the value of $\sqrt{83.6} \approx$ ___________ (3 decimal places)

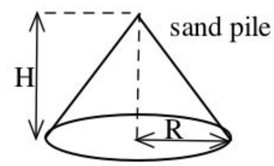
(c) For this f(x) and at x=81, df = ____________________

*(3) (3) (2)*

11. Do **2** of these problems. (If you do all three, I will only grade A and B.)

A. You are on a dock that is 10 feet above the surface of the water, and you are pulling in on a boat rope at a rate of 3 feet per minute. How fast is the boat approaching the bottom of the dock when the boat is 25 feet from the bottom of the dock? ____________________________ (include units)

B. Sand is pouring onto a pile so that the **height is always the same as the radius** of the pile. How fast is the **volume** of the sand pile changing when the height is 11 feet and the radius is increasing at a rate of 4 feet per day? ($V = \frac{1}{3}\pi R^2 H$)




____________________________ (include units)

C. A rectangle has a length of 20 feet and a width of 12 feet. The length is decreasing at a rate of 2 feet per hour and the width is increasing at a rate of 3 feet per hour. How fast is the rectangle's **Area** changing?

____________________________ (include units)

Problem A B C (circle one)

*(6 each)*

Problem A B C (circle one)

**BONUS:** (+2 if correct) Find a function g(x) so $D\left( g(x) \right) = \dfrac{3x^2 + \cos(x)}{x^3 + \sin(x)} + 15e^{3x}$.

g(x) = ________________________________________

**the end!** (points = 101 + 2 bonus. Tests back tomorrow.)