Exam 2 April 5, 2005 SHOW ALL WORK

Math 25 Calculus I Either circle your answers or place on answer line.

[10] 1a.) Use a linear approximation (or differentials) to estimate $ln(0.97)$

Answer 1a.) ____

[2] 1b.) Is the answer to 1a an over-estimate or an under-estimate? ________________

[2] 1c.) For the problem in 1a,

$dx =$ __________, $dy =$ __________, $\Delta x =$ __________, $\Delta y =$ ________________.

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[2] 2a.) The linearization of $f(x) = sin(x)$ at $x = 0$ is ________________

[2] 2b.) The linearization of $f(x) = cos(x)$ at $x = 0$ is ________________

[2] 2c.) The linearization of $f(x) = sin(x)$ at $x = \frac{\pi}{2}$ is ________________

[2] 2d.) The linearization of $f(x) = 2x + 1$ at $x = 0$ is ________________

[2] 2e.) Use the above linearizations to estimate the following:

$sin(0.1) \sim$ ______, $sin(\frac{3}{2}) \sim$ ______

[10] 3.) Recall that radioactive substances decay at a rate proportional to the remaining mass. The half-life of polonium-218 is 3 minutes. Suppose a sample originally has a mass of 400g. SIMPLIFY your answers to the following:

a.) A formula for the mass remaining after t minutes is ______________________________

b.) The mass remaining after 6 minutes is ______________________________

c.) When is the mass reduced to 10g? ______________________________

[15] 4.) Find the derivative of $x\ ln(\sqrt{3sin(x^2) - e^x + 1})$.
Circle your answer. You do NOT need to simplify.

[15] 5.) A plan flies horizontally at an altitude of 10km and passes directly over a tracking telescope on the ground. When the angle of elevation is $\pi/3$ (with respect to the tracking telescope, after it has passed over the tracking telescope), this angle is decreasing at a rate of $\pi/4$ rad/min. How fast is the plane traveling at that time. (Hint: you can use a right triangle).

Answer) ____

6.) Find the following for $f(x) = x^3 - 8x^2 + 16x = x(x-4)^2$ (if they exist; if they don't exist, state so). Use this information to graph f.

Note $f'(x) = 3x^2 - 16x + 16 = (x-4)(3x-4)$ and $f''(x) = 6x - 16$

[1.5] 6a.) critical numbers: ______________________

[1.5] 6b.) local maximum(s) occur at $x =$ ______________________

[1.5] 6c.) local minimum(s) occur at $x =$ ______________________

[1.5] 6d.) The global maximum of f on the interval [0, 5] is _______ and occurs at

$x =$ _______________

[1.5] 6e.) The global minimum of f on the interval [0, 5] is _______ and occurs at

$x =$ _______________

[1.5] 6f.) Inflection point(s) occur at $x =$ ______________________

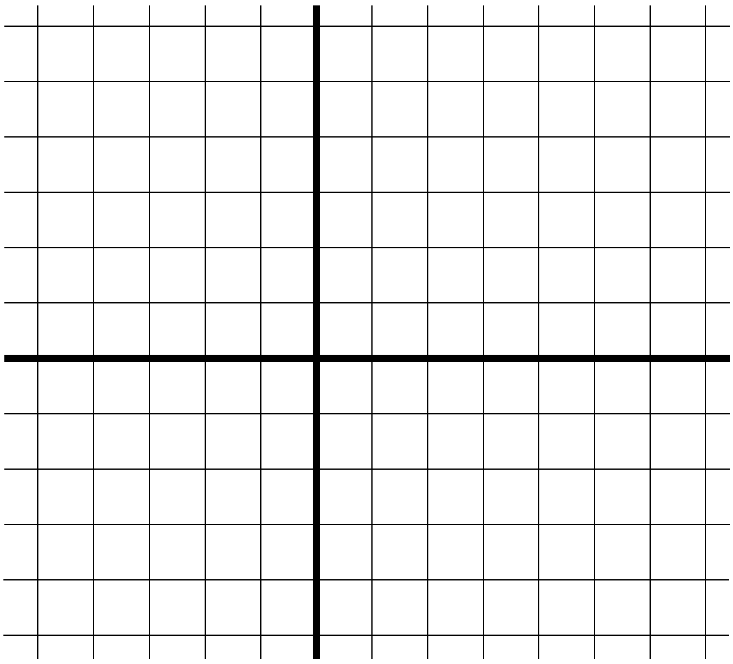
[1.5] 6g.) f increasing on the intervals ______________________

[1.5] 6h.) f decreasing on the intervals ______________________

[1.5] 6i.) f is concave up on the intervals ______________________

[1.5] 6j.) f is concave down on the intervals______________________

[5] 6k.) Graph f



[16] 7.) Circle T for true and F for false. If the statement is false, give a counter-example.

7a.) If $f'(x) > 0$ on an interval, then f is increasing on that interval. T

Counter-example: $\underline{None}$.

7b.) If f is increasing on an interval, then $f'(x) > 0$ on that interval. F

Counter-example: $f(x) = x^3$ is an increasing function on $(-\infty, \infty)$, but $f'(0) = 0$.

7c.) If $f'(c) = 0$, then f has a local maximum or local minimum at c. T F

Counter-example:

7d.) If f has a local maximum or local minimum at c, then $f'(c) = 0$. T F

Counter-example:

7e.) If f has a local maximum or local minimum at c and if $f'(c)$ exists, then $f'(c) = 0$.
T F

Counter-example:

7f.) Suppose f'' is continuous near x and $f'(c) = 0$. If $f''(c) > 0$, then f has a local minimum at c.
T F

Counter-example:

7g.) Suppose f'' is continuous near x and $f'(c) = 0$. If f has a local minimum at c, then $f''(c) > 0$.
T F

Counter-example:

7h.) If f is continuous on (a, b), then f attains an absolute maximum value $f(c)$ at some number c in (a, b).
T F

Counter-example: