Name: ______________________________

Instructor: __________________________

Math 10550, Exam II
October 17, 2013

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- No calculators.
- The exam lasts for 1 hr. and 15 m..
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 10 pages of the test.

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10.	(a)	(b)	(c)	(d)	(e)

Please do NOT write in this box.

Multiple Choice______________

11. ______________

12. ______________

13. ______________

Total ______________

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Multiple Choice

1.(6 pts.) A particle is moving along an axis. Its position at time t (seconds) is given by

$$s(t) = t^3 - 6t^2 + 9t,$$

where $s(t)$ is measured in feet. What is the total distance travelled by the particle between $t = 0$ and $t = 2$ seconds.

(a) 6 feet (b) 10 feet (c) 2 feet

(d) 4 feet (e) 5 feet

2.(6 pts.) The height of a rectangle is increasing at a rate of 8 cm/s and its width is increasing at a rate of 3 cm/s. When the height is 20 cm and the width is 10 cm, how fast is the area of the rectangle increasing?

(a) $190\,\mathrm{cm}^2/\mathrm{s}$ (b) $211\,\mathrm{cm}^2/\mathrm{s}$ (c) $140\,\mathrm{cm}^2/\mathrm{s}$

(d) $11\,\mathrm{cm}^2/\mathrm{s}$ (e) $24\,\mathrm{cm}^2/\mathrm{s}$

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3.(6 pts.) Use linear approximation of $f(x) = \dfrac{1}{\sqrt{x}}$ at $a = 4$ to estimate $\dfrac{1}{\sqrt{3.9}}$.

(a) $\dfrac{1}{\sqrt{3.9}} \approx \dfrac{79}{160}$

(b) $\dfrac{1}{\sqrt{3.9}} \approx \dfrac{11}{20}$

(c) $\dfrac{1}{\sqrt{3.9}} \approx \dfrac{1}{2}$

(d) $\dfrac{1}{\sqrt{3.9}} \approx \dfrac{9}{20}$

(e) $\dfrac{1}{\sqrt{3.9}} \approx \dfrac{81}{160}$

4.(6 pts.) Find the linearization $L(x)$ of the function $f(x) = \sin(2x)$ at $a = \dfrac{\pi}{4}$.

(a) $L(x) = 1 - \dfrac{\sqrt{2}\pi}{4} + \sqrt{2}x$

(b) $L(x) = 1$

(c) $L(x) = 1 - \dfrac{\pi}{2} + 2x$

(d) $L(x) = 1 + x$

(e) $L(x) = 1 + \dfrac{\pi}{2} - 2x$

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5.(6 pts.) Find all critical points (critical numbers) of

$$f(x) = x^4 + \frac{16}{3}x^3 - 10x^2 - 12.$$

(a) $x = -2, 0, 2$ (b) $x = 5, 0, -1$ (c) $x = -5, 1$

(d) $x = 0, -2$ (e) $x = -5, 0, 1$

6.(6 pts.) Let

$$f(x) = x^3 + 3x^2 - 24x.$$

Find the absolute maximum and absolute minimum values of f on the interval $[0, 10]$.

(a) Max at $x = 4$; Min at $x = 0$. (b) Max at $x = 10$; Min at $x = 0$.

(c) Max at $x = 4$; Min at $x = 1$. (d) Max at $x = 10$; Min at $x = 2$.

(e) Max at $x = 8$; Min at $x = 2$.

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7.(6 pts.) Find the local maxima and minima of

$$f(x) = 3x^{2/3} - x$$

where $f(x)$ is defined for all real numbers x.

(a) f has a local minimum at $x = 0$ and a local maximum at $x = 8$.

(b) f has a local maximum at $x = 8$ and no local minimum.

(c) f has a local maximum at $x = 0$ and a local minimum at $x = 1/8$.

(d) f has a local minimum at $x = 0$ and a local maximum at $x = 1/8$.

(e) f has a local maximum at $x = 1/8$ and no local minimum.

8.(6 pts.) Let

$$f(x) = \frac{1}{3}x^3 - \frac{3}{2}x^2 + 2x + 10.$$

On which of the following intervals is the graph of the function f **both** decreasing and concave upward on the entire interval?

(a) $(-\infty, 2)$

(b) $(1, 2)$

(c) $\left(-\infty, \frac{3}{2}\right)$

(d) $\left(\frac{3}{2}, 2\right)$

(e) $(0, 2)$

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9.(6 pts.) Consider the function

$$f(x) = \frac{3x^3 - 3}{(2x+2)(x^2 - 7x + 10)}.$$

Which of the following is true?

(a) f has a horizontal asymptote at $y = 1$ and vertical asymptotes at $x = -1, 2, 5$.

(b) f has a horizontal asymptote at $y = \frac{3}{2}$ and vertical asymptotes at $x = 1, 2, 5$.

(c) f has a horizontal asymptote at $y = \frac{3}{2}$ and vertical asymptotes at $x = -1, 2, 5$.

(d) f has a horizontal asymptote at $y = -1$ and vertical asymptotes at $x = -1, 2, 5$.

(e) f has a horizontal asymptote at $y = \frac{3}{2}, -\frac{3}{2}$ and vertical asymptotes at $x = -1, 2, 5$.

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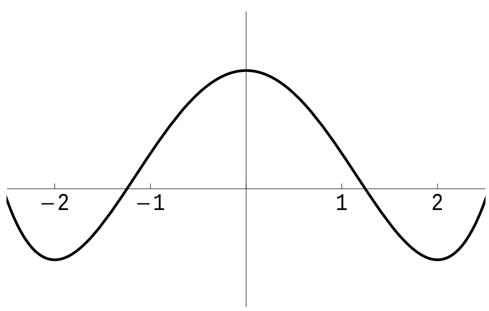
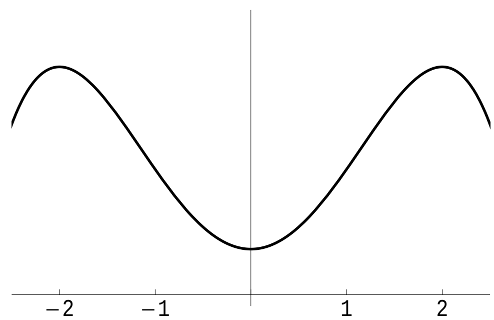
10.(6 pts.) Let f be a function of x. The table below shows whether the functions $f'(x)$ and $f''(x)$ are positive, negative or have value 0 at each of the given values of x.

x	-2	0	2
$f'(x)$	$=0$	$=0$	$=0$
$f''(x)$	>0	$=0$	<0

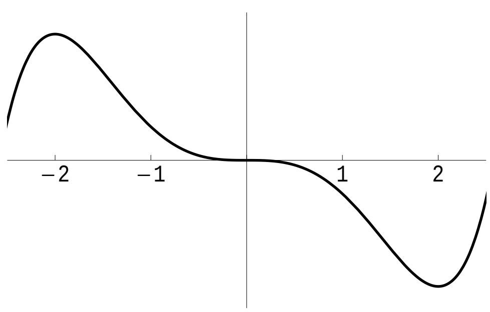
Which of the graphs shown below is a feasible graph of $f(x)$?
(**Note that the label for each graph is given on the lower left of the graph.**)



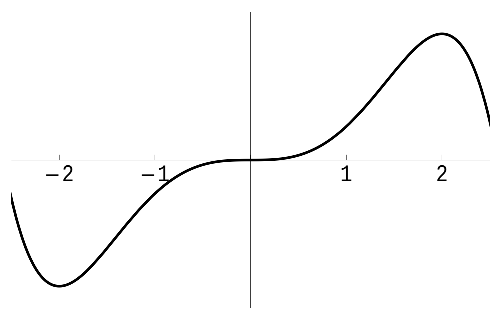
(a)



(b)



(c)



(d)

(e) None of the above

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Partial Credit

You must show your work on the partial credit problems to receive credit!

11.(13 pts.) Show that

$$x^5 + 2x^3 + 2x - 3 = 0$$

has one and exactly one solution. Identify the theorem(s) you are using.

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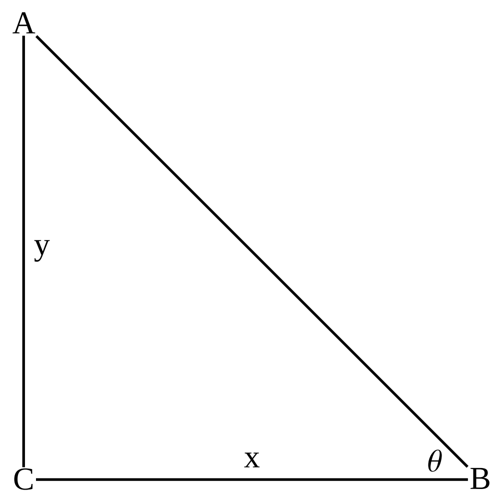
12.(13 pts.) Car A and car B are approaching the intersection "C" of two streets intersecting at a right angle. Car A is going South at 45 mph, car B is heading West at 30 mph. We denote the angle $\angle(C, B, A)$ by θ (measured in radians), the distance from C to B by x, and the distance from C to A by y. At what rate is the angle θ changing when car A and car B are both 1 mile from the intersection?



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13.(14 pts.) Suppose $f(x)$ is a function which is continuous and differentiable on the interval $\left(-\frac{3\pi}{4}, \frac{3\pi}{4}\right)$ with

$$f'(x) = 1 - \sin^2 x.$$

Warning: the formula shown above is for the DERIVATIVE of $f(x)$

(a) Find all critical points (critical numbers) of the function $f(x)$ in the given interval.

(b) List the subintervals of $\left(-\frac{3\pi}{4}, \frac{3\pi}{4}\right)$ where f is increasing / decreasing.

(c) List all local maxima and local minima of f in the interval $\left(-\frac{3\pi}{4}, \frac{3\pi}{4}\right)$, or say so if there are none.

(d) List the subintervals of $\left(-\frac{3\pi}{4}, \frac{3\pi}{4}\right)$ where f is concave up / concave down.

(e) List all inflection points of f in the interval $\left(-\frac{3\pi}{4}, \frac{3\pi}{4}\right)$, or say so if there are none.

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Instructor: ANSWERS

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