Name: _____

Instructor: _____

Math 10360, Exam 1
March 18, 2008

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- No calculators.
- The exam lasts for 1 hour and 15 min.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 11 pages of the test.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
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Multiple Choice	_____
13.	_____
14.	_____
15.	_____
16.	_____
Total	_____

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Multiple Choice

1.(5 pts.) Find the volume of the solid of revolution formed by rotating the region bounded by the curves $y = x^4$, $y = 0$ and $x = 6$ about the **y-axis**.

(a) $\pi\left(216 - \frac{6^9}{9}\right)$ (b) $2\pi(6^5)$ (c) 6^5

(d) $\frac{2\pi}{3}(25^3)$ (e) $\frac{\pi(6^9)}{9}$

2.(5 pts.) Find the arc length of the curve $y = \frac{x^2}{4} - \frac{1}{2}\ln(x)$ from $x = 1$ to $x = 3$.

(a) $2 + \frac{1}{2}\ln(3)$ (b) $\frac{32}{3}$ (c) $4 - \frac{1}{2}\ln(3)$ (d) $4 + \ln(3)$ (e) $3 + \ln(2)$

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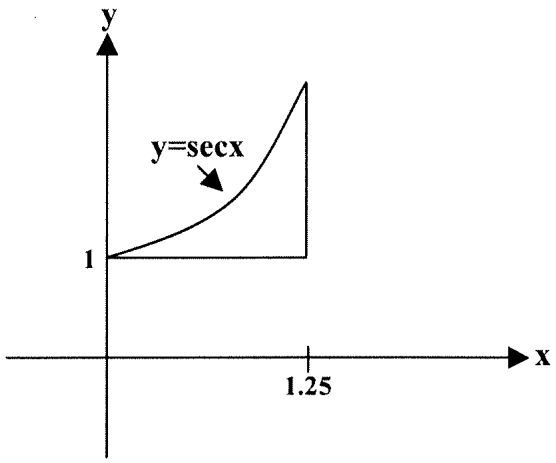
3.(5 pts.) Set up the integral that finds the volume of the surface of revolution formed by rotating the region bounded by $y = \sec(x)$, $y = 1$, $x = 0$ and $x = 1.25$ around the **y-axis** using the **shell method** (the region is pictured below).



(a) $\int_0^{1.25} 2\pi x \sec(x) dx$

(b) $\int_0^{1.25} 2\pi(1.25 - x)(\sec(x) - 1) dx$

(c) $\int_0^{1.25} 2\pi(1.25 - x) \sec(x) dx$

(d) $\int_0^{1.25} \pi \sec^2(x) dx$

(e) $\int_0^{1.25} 2\pi x(\sec(x) - 1) dx$

4.(5 pts.) Suppose we gave a one dimensional system of 4 masses: $m_1 = 4$, $m_2 = 10$, $m_3 = 7$, and $m_4 = 11$ located at $x_1 = -3$, $x_2 = 10$, $x_3 = 11$ and $x_4 =$? respectively. What should the value of x_4 be to ensure that the center of mass well be at $\overline{x} = 0$?

(a) 0 (b) -10 (c) 13 (d) -14 (e) -15

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5.(5 pts.) Find the surface area of the surface formed by revolving the curve $y = \dfrac{x^3}{3}$ from $x = \sqrt[4]{3}$ to $x = \sqrt[4]{8}$ around the **x-axis**.

(a) $\dfrac{10\pi}{12}$ (b) $\dfrac{19\pi}{9}$ (c) $\dfrac{\pi}{6}$

(d) $\pi\left((\sqrt[4]{8})^2 - (\sqrt[4]{3})^2\right)$ (e) $\dfrac{19\pi}{6}$

6.(5 pts.) Find the definite integral $\displaystyle\int_0^2 \frac{2x}{x^2+6x+9}dx$.

(a) $\ln(25) + \dfrac{6}{5}$ (b) $\ln(25)$

(c) $2\ln(2) + \dfrac{10}{9}$ (d) $\ln(25) - \ln(9) - \dfrac{4}{5}$

(e) $\ln(25) + \ln(9) + \dfrac{6}{5}$

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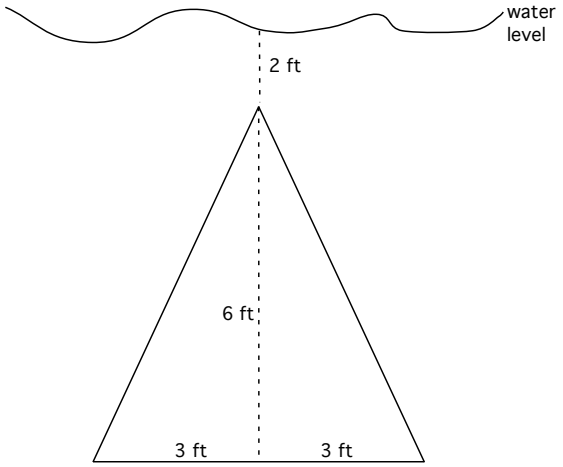
7.(5 pts.) A plate the shape of an isoceles triangle with base 6ft and height 6ft is submerged vertically in a tank of water so that the top of the triangle is 2 feet under water (see figure below). Suppose that water weighs ω pounds per cubic foot. Find the fluid force on the surface of the plate.



(a) $36w$ (b) $108w$ (c) $54\pi w$ (d) $72w$ (e) $54w$

8.(5 pts.) The integrating factor, $u(x)$, for the first order linear differential equation

$$y' - \sec^2(x)y = x^3 + 1$$

is

(a) $\tan(x)$ (b) e^{x^4+x} (c) $e^{-\tan(x)}$

(d) $-\tan(x)$ (e) $e^{\tan(x)}$

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9.(5 pts.) A square has vertices $(3,3)$, $(1,5)$, $(3,7)$, and $(5,5)$. Find the volume of the solid of revolution obtained by rotating this square about the **x-axis**.

(a) 80π (b) 48 (c) 48π (d) $200\pi^2$ (e) 80

10.(5 pts.) Find the area between the curves $y = (x-1)^2$ and $y = x + 1$.

(a) $-\frac{9}{2}$ (b) $\frac{27}{2}$ (c) $\frac{9}{2}$ (d) $\frac{9^3}{2}$ (e) $\frac{54}{2}$

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11.(5 pts.) Find the indefinite integral $\int xe^{3x}dx$.

(a) $\frac{1}{6}x^2e^{3x}+C$ (b) $\frac{1}{3}xe^{3x}+\frac{1}{9}e^{3x}+C$ (c) $\frac{1}{3}e^{3x}+C$

(d) $xe^{3x}-e^{3x}+C$ (e) $\frac{1}{3}xe^{3x}-\frac{1}{9}e^{3x}+C$

12.(5 pts.) Find the volume of the solid of revolution formed by rotating the region bounded by the curves $y=x^{1/3}$ (i.e $x=y^3$) , $y=2$, and $x=0$ around the **y-axis**.

(a) $\frac{128\pi}{7}$ (b) 24π (c) $\frac{3\pi(\sqrt[3]{2})^4}{4}$ (d) 12π (e) $\frac{64\pi}{5}$

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Partial Credit

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

13.(10 pts.) Find the solution to the first order linear differential equation

$$y' + \frac{2}{x}y = e^{x^3}$$

satisfying the initial condition $\left(1, \frac{4e}{3}\right)$.

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14.(10 pts.) A force of 24 Newtons is required to stretch a spring 0.8 meters from its original position.

a) Find the spring constant, k, for the spring described above.

b) Calculate the work done to stretch the spring from 1 meter to 3 meters beyond its natural length.

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15.(10 pts.) A region with uniform density $\rho = 1$ is bounded by the curves $y = 3x + 2$, $y = 2$, $x = 0$ and $x = 2$.

a) Find the mass, M, of the region.

b) Find the moment of the region about the x-axis, M_x.

c) Find the y coordinate of the center of mass, $\overline{y}$.

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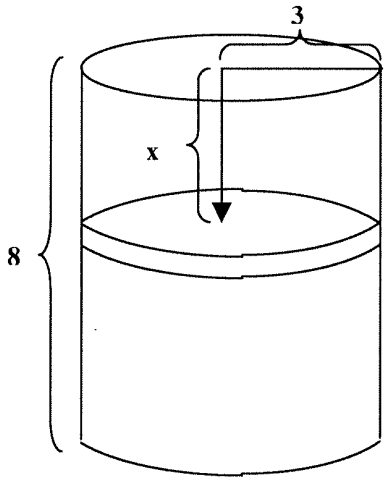
16.(10 pts.) Suppose we have an 8-foot tall cylindrical oil drum that has a circular base with 3-foot radius (pictured below). Suppose the drum is full of oil which weighs w pounds per cubic foot.



a) A horizontal slice is shown in the picture. Find the volume of the slice.

b) Find the work done in pumping the slice out of the oil drum.

c) Find the total amount of work done to pump out the **top half** of the oil?

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