MATH 259 – FIRST UNIT TEST

Tuesday, February 24, 2009.

NAME: _____

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A	C	D	G	H
B	F	E		

Instructions:

1. Do not separate the pages of the exam. If any pages do become separated, write your name on them and point them out to your instructor when you turn in the exam.
2. Please read the instructions for each individual question carefully. One of the skills being tested on this exam is your ability to interpret questions, so instructors will not answer questions about exam problems during the exam.
3. Show an appropriate amount of work for each exam question so that graders can see your final answer **and** how you obtained it.
4. You may use your calculator on all exam questions except where otherwise indicated. However, if you are asked to find an ***exact*** value of a quantity that involves an integral then you should not use calculator integration for this.
5. If you use graphs or tables to obtain an answer (especially if you create the graphs or tables on your calculator), be certain to provide an explanation and a sketch of the graph to show how you obtained your answer.
6. Please **TURN OFF** all cell phones and pagers, and **REMOVE** all headphones.

Problem	Total	Score
1	20	
2	12	
3	22	
4	26	
5	20	
Total	100	

1. 20 Points. SHOW ALL WORK. NO WORK = NO CREDIT.

You should not use your calculator on this problem for anything except evaluating functions or arithmetic. In particular, you should not use your calculator to evaluate integrals or find anti-derivatives.

You may use the following trigonometric identity without having to justify it:

$$\sqrt{2\cdot\left(1-\cos(\theta)\right)} = 2\cdot\sin\left(\frac{\theta}{2}\right).$$

(a) **(8 points)** Find the volume of the parallelpiped with adjacent edges PQ, PR and PS, where P, Q, R and S are the points:

$P = (3, 0, 1)$ $Q = (-1, 2, 5)$ $R = (5, 1, -1)$ $S = (0, 4, 2)$.

Clearly indicate your final answer.

Continued on the next page.

You should not use your calculator on this problem for anything except evaluating functions or arithmetic. In particular, you should not use your calculator to evaluate integrals or find anti-derivatives.

You may use the following trigonometric identity without having to justify it:

$$\sqrt{2 \cdot \left(1 - \cos(\theta)\right)} = 2 \cdot \sin\left(\frac{\theta}{2}\right).$$

(b) **(12 points)** Find the **exact** length of one arch of the parametric curve:

$$x(t) = r \cdot \left(t - \sin(t)\right) \qquad \text{and} \qquad y(t) = r \cdot \left(1 - \cos(t)\right).$$

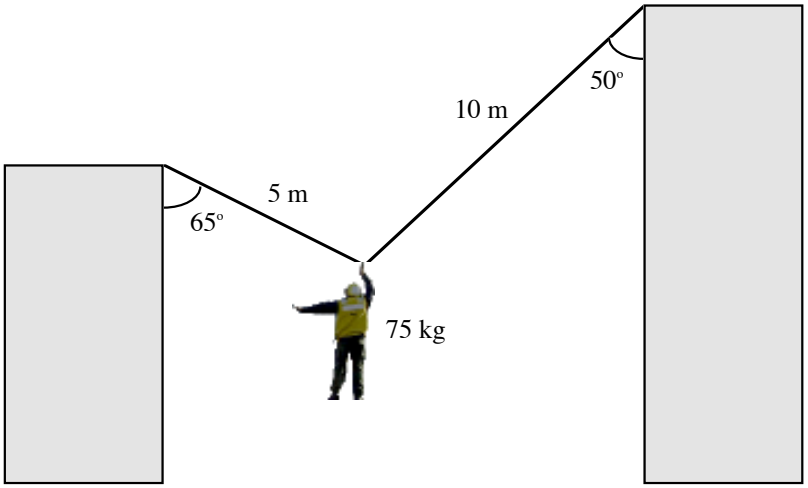
Your final answer may include the positive constant $r > 0$.

2. 12 Points. SHOW ALL WORK. NO PARTIAL CREDIT WITHOUT WORK.

The Great Brunetti is a tightrope walker. The Great Brunetti captivates his audiences by using a specially constructed balancing pole that makes it appear to audience members that he is off balance and might fall.

Unfortunately for the Great Brunetti, occasionally he does fall. The diagram below shows such an accident where the Great Brunetti was attempting to walk a tightrope between two skyscrapers. As he fell, the Great Brunetti managed to grab the rope.

One part of the rope is 5 meters in length; the other part of the rope is 10 meters in length. The Great Brunetti has a mass of 75 kg. Find the magnitude of the tension in each length of rope. Clearly indicate your final answers and give appropriate units.

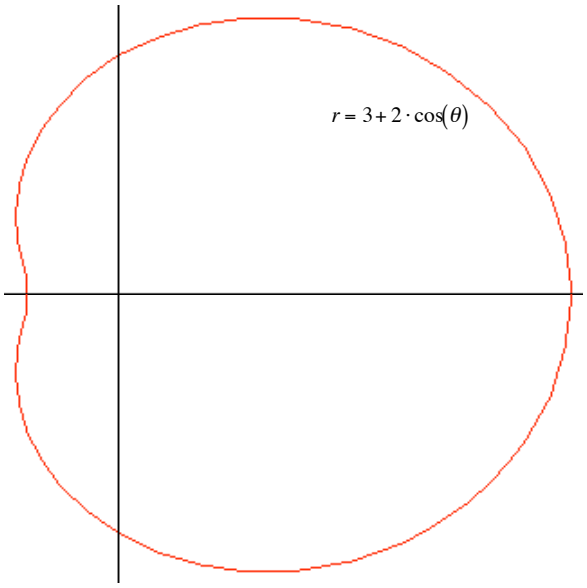


3. 22 Points. SHOW YOUR WORK. NO WORK = NO CREDIT.

Consider the curve defined by the polar equation:

$$r = 3 + 2 \cdot \cos(\theta).$$

(a) **(14 points)** Find the coordinates (x and y) of all points where the tangent line to the polar curve is **vertical**. Find the **exact** coordinates (x and y) of **all** points where the tangent line is vertical. Show your work and record your results in the table at the bottom of the page. No work = no credit.



If you give your answers in decimal form, include **at least four (4) decimal places**.

x	*y*

Continued on the next page.

Consider the curve defined by the parametric equations:

$$x(t) = e^{2t} - e^{-2t} \quad \text{and} \quad y(t) = 3e^{2t} + e^{-2t}.$$

(b) **(8 points)** Find the coordinates (x and y) of **all** points where the tangent line to the parametric curve is **horizontal**. Find the **exact** coordinates (x and y) of **all** points where the tangent line is horizontal. Show your work and record your results in the table below. No work = no credit.

If you give your answers in decimal form, include **at least four (4) decimal places**.

x	y

4. 26 Points. SHOW YOUR WORK. NO WORK = NO CREDIT.

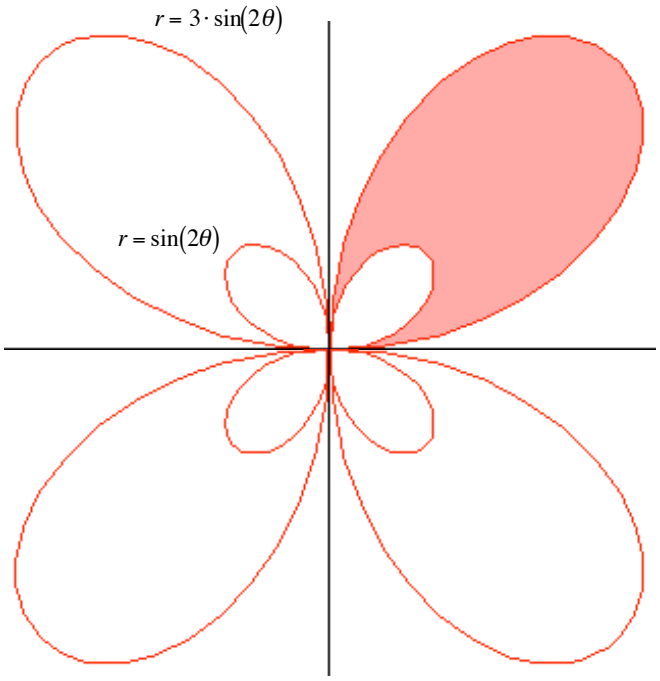
Find the **exact** area of each shaded region shown below. Show your work – no work = no credit.

You should not use your calculator on this problem for anything except evaluating functions or arithmetic. In particular, you should not use your calculator to evaluate integrals or find anti-derivatives.

You may use the following trigonometric identities without having to verify them:

$$\sin^2(x) = \tfrac{1}{2}(1 - \cos(2x)) \qquad \cos^2(x) = \tfrac{1}{2}(1 + \cos(2x)).$$

(a) (12 points)



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Find the area of each shaded region shown below. Show your work – no work = no credit.

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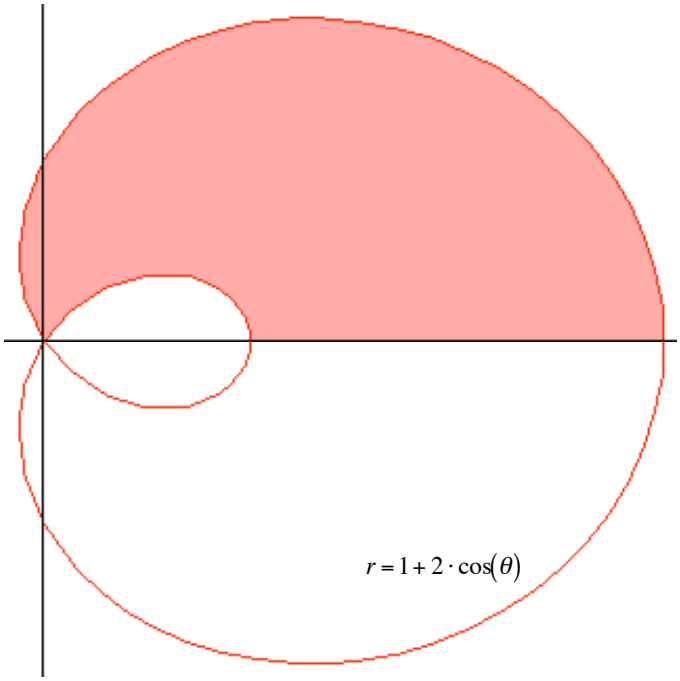
You may use the following trigonometric identities without having to verify them:

$$\sin^2(x) = \tfrac{1}{2}\left(1 - \cos(2x)\right) \qquad \cos^2(x) = \tfrac{1}{2}\left(1 + \cos(2x)\right).$$

(b) (14 points)



5. 20 Points. NO PARTIAL CREDIT WITHOUT WORK.

(a) (8 points) Find symmetric equations for the line of intersection formed by the planes:

$$x + y + z = 2 \qquad \text{and} \qquad x - 2y + 3z = 6.$$

(b) (6 points) Find the equation of the plane that contains all of the following points:

$$(1, 3, 2) \qquad (3, -1, 6) \qquad (5, 2, 0).$$

Continued on the next page.

(c) **(6 points)** Find the area of the triangle formed by the following points:

$$(1, 2, 3) \qquad (3, 0, -1) \qquad (2, 2, 2).$$