

Name _____ Calculus 2 Test 2A Fall 2009 Mike Huff

Calculus 2
MATH 2414
Test 2B
Fall 2009
Mike Huff

Tools: Any calculator
Deadline: 10/23/2009

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Show all work on the test paper for partial credit. No TI-89 solutions allowed.

(8 points)

1. Find the area of the region bounded by the curves $y = \frac{1}{x}$, $y = x$, and the line $x = 3$.

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(8 points)

2. Find the area of an ellipse using calculus. Hint: Use the parametric equations:

$$x = a \cos t, y = b \sin t .$$

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(8 points)

3. Find the average value of the function $f(x) = x \ln x$ on the interval $x \in [1, e]$.

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(10 points)

4. Find the volume of the solid generated by revolving about the x -axis the region bounded by $y = x^2$ and $y^2 = 8x$.

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(10 points)

5. Find the volume of the solid generated by revolving about the y -axis the region bounded by $y = x^2$ and $y^2 = 8x$.

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(8 points)

6. The region bounded by the line $y = \left(\frac{r}{h}\right)x$, the x -axis, and the line $x = h$ is revolved around the x -axis, thereby generating a cone. Find its volume using disks.

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(8 points)

7. The region bounded by the line $y = \left(\frac{r}{h}\right)x$, the x -axis, and the line $x = h$ is revolved around the x -axis, thereby generating a cone. Find its volume using shells.

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(8 points)

8. Find the length of the arc of the curve $y = \frac{4\sqrt{2}}{3}x^{3/2} - 1$ from $x = 0$ to $x = \frac{\pi}{4}$.

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(8 points)

9. Find the length of the arc of the curve defined by the parametric equations $x = \cos^3 t$ and $y = \sin^3 t$ from $t=0$ to $t=2\pi$.

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(12 points)

10. Let $f(t) = \frac{1}{6}e^{-t/6}$ be the probability density function for time in minutes that it will take a student to work this problem. Then, T is a continuous random variable with probability density function

$$f(t) = \begin{cases} \frac{1}{6}e^{-t/6} & x \geq 0 \\ 0 & otherwise \end{cases}$$

- a) Show that this is indeed a probability density function, i.e. Show that

$$\int_{-\infty}^{\infty} f(t)dt = 1$$

- b) Determine the probability that a student will be able to do this problem in less than 6 minutes.

- c) Determine the probability that a student will take more than 5 minutes to

do this problem.

d) Find the median time to complete this question, t_m . This is the value of t for which

$$F(t_m) = P(T \leq t_m) = \frac{1}{2}$$

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(6 points each – Do two of the three.)

11. If the natural length of a string is 0.2 meter, and if it takes a force of 12 Newtons to keep it extended 0.04 meter, find the work done in stretching the spring from its natural length to a length of 0.3 meter.
12. The density of a rod 9 meters long is \sqrt{x} kg/m at a distance of x meters from one end of the rod. Find the average density of the rod.
13. A right circular cylinder tank of height 1 foot and radius 1 foot is full of water. Taking the density of water to be 60 pounds per cubic foot, how much work in foot-pounds is required to pump all of the water up and over the top of the tank?

