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MATH 251

Exam 1A Fall 2015

Sections 511/512 (circle one)

P. Yasskin

1-12	/60
13	/16
14	/12
15	/12
Total	/100

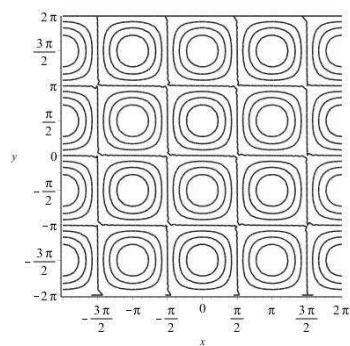
Multiple Choice: (5 points each. No part credit.)

1. If $\vec{a} = (4, -2, 1)$ and $\vec{b} = (2, -1, 1)$, then $|\vec{a} - 3\vec{b}| =$

- a. 1
- b. 3
- c. 5
- d. 9
- e. 13

2. The plot at the right is the contour plot of which function?

- a. $\sin(x) \cos(y)$
- b. $\sin(x) \sin(y)$
- c. $\cos(x) \cos(y)$
- d. $\cos(x) \sin(y)$
- e. $\sin(xy)$



3. Suppose $\text{proj}_{\vec{v}}\vec{u} = (3, 1)$. Which of the following is **inconsistent** with this fact?

- a. $\text{proj}_{\perp\vec{v}}\vec{u} = (2, -6)$
- b. $\text{proj}_{\perp\vec{v}}\vec{u} = (-2, 6)$
- c. $\vec{u} = (4, -2)$
- d. $\vec{v} = (6, 2)$
- e. $\vec{v} = (1, -3)$

4. Which of the following is an ellipse in the 1st quadrant tangent to both the x and y -axes?

- a. $9(x - 3)^2 + 4(y - 2)^2 = 36$
- b. $4(x - 3)^2 + 9(y - 2)^2 = 36$
- c. $4(x - 2)^2 + 9(y - 3)^2 = 36$
- d. $4(x - 3)^2 + 9(y - 2)^2 = 1$
- e. $9(x - 2)^2 + 4(y - 3)^2 = 1$

5. In 3-dimensional space, the equation $x^2 - 4x - y^2 + 6y + z^2 = 5$ is

- a. a hyperboloid with center $(2, 3, 0)$ and axis $\vec{r}(t) = (2, 3, t)$.
- b. a hyperboloid with center $(2, 3, 0)$ and axis $\vec{r}(t) = (2, 3 + t, 0)$.
- c. a hyperbolic cylinder with axis $\vec{r}(t) = (2, 3, t)$.
- d. a cone with vertex $(2, 3, 0)$ and axis $\vec{r}(t) = (2, 3 + t, 0)$.
- e. two planes which intersect at the line $\vec{r}(t) = (2, 3 + t, 0)$.

6. If \vec{u} points SOUTHEAST and \vec{v} points UP, where does $\vec{u} \times \vec{v}$ point?

- a. DOWN
- b. SOUTHWEST
- c. WEST
- d. NORTHEAST
- e. NORTHWEST

7. Find the intersection of the line $(x, y, z) = (2t, -1 + 2t, 2 + 2t)$ and the plane $3x - 2y + z = 8$. At this point $x + y + z =$

- a. -3
- b. -1
- c. 0
- d. 5
- e. 7

8. Compute $\lim_{h \rightarrow 0} \frac{(2x + 2h + 3y)^2 - (2x + 3y)^2}{h}$

- a. $2x + 3y$
- b. $4x + 6y$
- c. $6x + 9y$
- d. $8x + 12y$
- e. $12x + 18y$

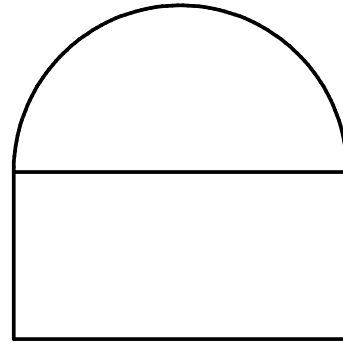
9. Find the plane tangent to the graph of $z = x^2e^{2y}$ at $(3,0)$. The z -intercept is

- a. -27
- b. -18
- c. -9
- d. 9
- e. 18

10. If $S(3,2) = 5$ and $\frac{\partial S}{\partial x}(3,2) = -0.3$ and $\frac{\partial S}{\partial y}(3,2) = 0.4$, estimate $S(3.2,1.7)$.

- a. 4.82
- b. 4.9
- c. 5.0
- d. 5.1
- e. 5.18

11. A semicircle sits on top of a rectangle of width $2r$ and height h . If the radius decreases from 3 cm to 2.97 cm while the height increases from 4 cm to 4.02 cm, use the linear approximation to determine whether the area increases or decreases and by how much.



- a. increases by $0.09\pi - 0.12$
 - b. increases by $0.09\pi + 0.12$
 - c. increases by $0.09\pi + 0.36$
 - d. decreases by $0.09\pi + 0.36$
 - e. decreases by $0.09\pi + 0.12$
12. The temperature in a room is $T = z^2(2x + 3y)$. Currently, a fly is at $\vec{r} = (4, 3, 2)$ and has velocity $\vec{v} = (3, 2, 1)$. What is the rate of change of the temperature as seen by the fly?
- a. 16
 - b. 116
 - c. 64
 - d. 164
 - e. 264

Work Out: (Points indicated. Part credit possible. Show all work.)

13. (16 points) For the parametric curve $\vec{r}(t) = \left(\frac{2}{t}, 6t, 3t^3\right)$ compute each of the following:

a. velocity \vec{v}

b. speed $|\vec{v}|$ HINT: The quantity inside the square root is a perfect square.

c. arc length $L = \int_{(2,6,3)}^{(1,12,24)} ds$

d. acceleration \vec{a}

e. unit binormal \hat{B}

f. tangential acceleration a_T

14. (12 points) A wire has the shape of the parametric curve $\vec{r}(t) = \left(\frac{2}{t}, 6t, 3t^3\right)$ between $(2, 6, 3)$ and $(1, 12, 24)$. Find the mass of the wire if the linear mass density is $\rho = \frac{1}{12}xyz$.
Don't simplify the answer.

15. (12 points) A mass slides along a wire which has the shape of the parametric curve $\vec{r}(t) = \left(\frac{2}{t}, 6t, 3t^3\right)$ between $(2, 6, 3)$ and $(1, 12, 24)$ under the action of the force $\vec{F} = (z, y, x)$. Find the work done by the force.