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MATH 251

Exam 1C 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.)

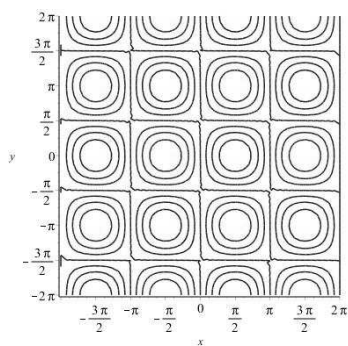
1. If $\vec{a} = (2, -6, -2)$ and $\vec{b} = (-1, -2, 1)$, then $|\vec{a} - 2\vec{b}| =$

- a. 1
- b. 3
- c. 5
- d. 6
- e. 13

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

HINT: Where is the level set with value 0?

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



3. Find the projection of the vector $\vec{u} = (1, 1, 3)$ onto the vector $\vec{v} = (2, 1, -2)$ and is the angle between these vectors acute or obtuse?

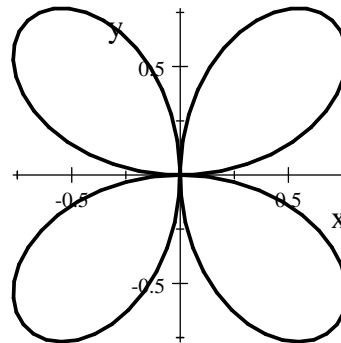
- a. $(\frac{-1}{11}, \frac{-1}{11}, \frac{-3}{11})$, obtuse
- b. $(\frac{-1}{11}, \frac{-1}{11}, \frac{-3}{11})$, acute
- c. $(\frac{-2}{3}, \frac{-1}{3}, \frac{2}{3})$, obtuse
- d. $(\frac{-2}{3}, \frac{-1}{3}, \frac{2}{3})$, acute
- e. $(\frac{-2}{11}, \frac{-1}{11}, \frac{2}{11})$, obtuse

4. Find the asymptotes of the hyperbola $4(x - 3)^2 - 9(y - 2)^2 = 36$.

- a. $y = 2 \pm \frac{3}{2}(x - 3)$
- b. $y = 2 \pm \frac{2}{3}(x - 3)$
- c. $y = 3 \pm \frac{3}{2}(x - 2)$
- d. $y = 3 \pm \frac{2}{3}(x - 2)$
- e. $y = -3 \pm \frac{2}{3}(x + 2)$

5. The plot at the right is the graph of which polar curve?

- a. $r = \cos(2\theta)$
- b. $r = \sin(2\theta)$
- c. $r = \cos(4\theta)$
- d. $r = \sin(4\theta)$



6. Find the volume of the parallelepiped with edge vectors $\vec{u} = (1, -1, 1)$, $\vec{v} = (2, 1, 0)$, and $\vec{w} = (0, 1, -2)$.

- a. -8
- b. -4
- c. 4
- d. 6
- e. 8

7. Find the line through the points $A = (8, 4, -6)$ and $B = (10, 5, -9)$. It passes through the xy -plane at:

- a. $(4, 2, 0)$
- b. $(8, 4, 0)$
- c. $(10, 5, 0)$
- d. $(-8, -4, 0)$
- e. $(-10, -5, 0)$

8. Compute $\lim_{h \rightarrow 0} \frac{(4x + 4h + 3y)^2 - (4x + 3y)^2}{h}$

- a. $4x + 3y$
- b. $8x + 6y$
- c. $16x + 12y$
- d. $24x + 18y$
- e. $32x + 24y$

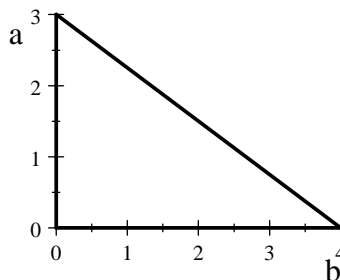
9. Find the plane tangent to the graph of $z = x^3e^{2y}$ at $(2,0)$. The z -intercept is

- a. -24
- b. -16
- c. -8
- d. 8
- e. 16

10. If $Q(2,3) = 6$ and $\frac{\partial Q}{\partial x}(2,3) = 0.3$ and $\frac{\partial Q}{\partial y}(2,3) = -0.2$, estimate $Q(2.2,2.7)$.

- a. 5.88
- b. 5.9
- c. 6.0
- d. 6.1
- e. 6.12

11. A right triangle has sides a and b . If a increases from 3 cm to 3.02 cm, while b decreases from 4 cm to 3.98 cm, use the linear approximation to determine whether the hypotenuse increases or decreases and by how much.



- a. increases by 0.0028
b. increases by 0.004
c. increases by 0.028
d. decreases by 0.004
e. decreases by 0.028
12. The oxygen density in a fish tank is given by $\rho = (x^2 + y^2)(15 - z)$. Currently, a fish is at $\vec{r} = (3, 4, 5)$ and has velocity $\vec{v} = (3, 2, 1)$. What is the rate of change of the oxygen density as seen by the fish?
- a. 9
b. 115
c. 315
d. 365
e. 375

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

13. (16 points) For the parametric curve $\vec{r}(t) = \left(\frac{1}{2}t^2, \frac{2}{3}t^3, \frac{1}{2}t^4\right)$ 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 $L = \int_{(0,0,0)}^{(2, \frac{16}{3}, 8)} ds$

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 $\vec{r}(t) = \left(\frac{1}{2}t^2, \frac{2}{3}t^3, \frac{1}{2}t^4\right)$ between $(0,0,0)$ and $\left(2, \frac{16}{3}, 8\right)$. Find the mass of the wire if the linear mass density is $\rho = 4xz$. Don't simplify the answer.

15. (12 points) A mass slides along a wire which has the shape of the parametric curve $\vec{r}(t) = \left(\frac{1}{2}t^2, \frac{2}{3}t^3, \frac{1}{2}t^4\right)$ between $(0,0,0)$ and $\left(2, \frac{16}{3}, 8\right)$ under the action of the force $\vec{F} = (4z, 3y, 2x)$. Find the work done by the force.