

Name _____

MATH 251 Exam 1 Version A Fall 2017

Sections 515 P. Yasskin

1-9	/54	11	/16
10	/33	Total	/103

Multiple Choice: (6 points each. No part credit.)

1. The points $A = (2, -3, 4)$ and $B = (4, 1, 0)$ are the endpoints of the diameter of a sphere. What is the radius of the sphere?

- a. 6
- b. 5
- c. 4
- d. 3
- e. 2

2. The points $A = (2, -3, 4)$ and $B = (4, 1, 0)$ are the endpoints of the diameter of a sphere. What is the center of the sphere?

- a. $(6, -2, 4)$
- b. $(6, 2, 4)$
- c. $(3, -1, 2)$
- d. $(3, 1, 2)$
- e. $(2, 4, -4)$

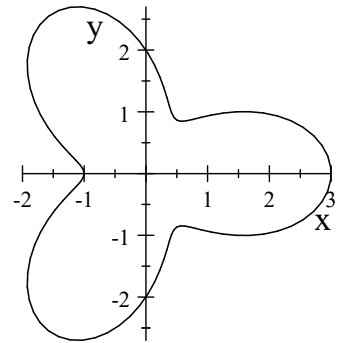
3. Find the angle between the normals to the planes $3x + 2y - 4z = 3$ and $2x - y + z = 2$.

- a. 0°
- b. 30°
- c. 45°
- d. 60°
- e. 90°

4. Duke Skywater pushes an asteroid from the point $P = (2, -3, 5)$ to the point $Q = (5, -1, 4)$ by the force $\vec{F} = (4, 1, 2)$. Find the work done to move the asteroid.
- 16
 - 12
 - 6
 - 4
 - 2

5. The plot at the right is which polar equation?

- $r = 2 + \cos 3\theta$
- $r = 2 - \cos 3\theta$
- $r = 1 + 2 \cos 3\theta$
- $r = 1 - 2 \cos 3\theta$
- $r = 1 + \cos 3\theta$



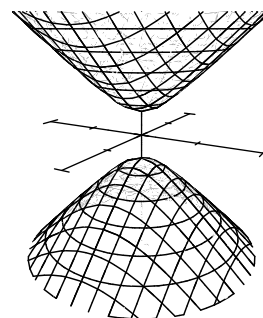
6. Find a vector perpendicular to the plane containing the points $P = (2, 1, 4)$, $Q = (-1, 3, 2)$ and $R = (3, 1, 2)$
- $(-4, 2, -4)$
 - $(2, 4, 1)$
 - $(2, -2, 1)$
 - $(-4, 8, -2)$
 - $(2, -1, 2)$

7. If $|\vec{u}| = 2$ and $|\vec{v}| = 5$ and $\vec{u} \cdot \vec{v} = 6$ find $|\vec{u} \times \vec{v}|$.

- a. 8
- b. 6
- c. 4
- d. 2
- e. 0

8. The plot at the right is the graph of which equation?

- a. $x^2 + y^2 - z^2 = 1$
- b. $x^2 + y^2 - z^2 = 0$
- c. $x^2 + y^2 - z^2 = -1$
- d. $x^2 + y^2 - z = 1$
- e. $x^2 + y^2 - z = -1$



9. Find the point where the line $(x, y, z) = \vec{r}(t) = (2t + 1, t - 1, 2t - 1)$ intersects the plane $3x + 2y + z = 20$.

At this point $x + y + z =$

- a. -6
- b. -1
- c. 4
- d. 9
- e. 13

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

10. (33 points) For the parametric curve $\vec{r}(t) = \left(\frac{2}{t}, 6t, 3t^3\right)$ compute each of the following:

a. (3 pts) velocity \vec{v}

$$\vec{v} = \underline{\hspace{10cm}}$$

b. (3 pts) acceleration \vec{a}

$$\vec{a} = \underline{\hspace{10cm}}$$

c. (3 pts) jerk \vec{j}

$$\vec{j} = \underline{\hspace{10cm}}$$

d. (3 pts) speed $|\vec{v}|$ (Simplify!)

HINT: The quantity inside the square root is a perfect square.

$$|\vec{v}| = \underline{\hspace{10cm}}$$

e. (3 pts) tangential acceleration a_T

$$a_T = \underline{\hspace{10cm}}$$

f. (4 pts) unit binormal \hat{B} (Do this last.)

$$\hat{B} = \underline{\hspace{10cm}}$$

Recall: $\vec{r}(t) = \left(\frac{2}{t}, 6t, 3t^3\right)$

g. (2 pts) the values of t where the curve passes thru the points

$A = (2, 6, 3)$

$t = \underline{\hspace{2cm}}$

$B = (1, 12, 24)$

$t = \underline{\hspace{2cm}}$

h. (4 pts) arc length between $(2, 6, 3)$ and $(1, 12, 24)$, $L = \int_{(2,6,3)}^{(1,12,24)} ds$

$L = \underline{\hspace{2cm}}$

i. (4 pts) A wire has the shape of this curve between $(2, 6, 3)$ and $(1, 12, 24)$. Find the mass of the wire if the linear mass density is $\rho = \frac{1}{6}xz$.

(Don't simplify the answer.)

$M = \underline{\hspace{2cm}}$

j. (4 pts) A wire has the shape of this curve. Find the work done by the force $\vec{F} = (z, y, x)$ which pushes a bead along the wire from $(2, 6, 3)$ to $(1, 12, 24)$.

$W = \underline{\hspace{2cm}}$

11. (16 points) Are the following lines parallel, intersecting or skew? If they intersect, find the point of intersection.

a. Line 1: $\vec{r}_1(t) = (t + 2, t - 2, 2t - 1)$

Line 2: $\vec{r}_2(t) = (t + 1, 2t - 6, 2t - 1)$

b. Line 1: $\vec{r}_1(t) = (t + 2, t - 2, 2t + 1)$

Line 2: $\vec{r}_2(t) = (t + 1, 2t - 6, 2t - 1)$