Name________________________

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

MATH 251 Exam 1 Version H Fall 2017

Sections 200 P. Yasskin

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. Consider the permutation $p = (2,6,4,1,3,5)$. Find its inverse and parity (odd vs. even).

a. $\bar{p} = (4,1,5,3,6,2) \qquad \varepsilon_p = 1$

b. $\bar{p} = (4,1,5,3,6,2) \qquad \varepsilon_p = -1$

c. $\bar{p} = (2,6,3,5,1,4) \qquad \varepsilon_p = 1$

d. $\bar{p} = (2,6,3,5,1,4) \qquad \varepsilon_p = -1$

e. $\bar{p} = (5,3,1,4,6,2) \qquad \varepsilon_p = 1$

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.

a. 16

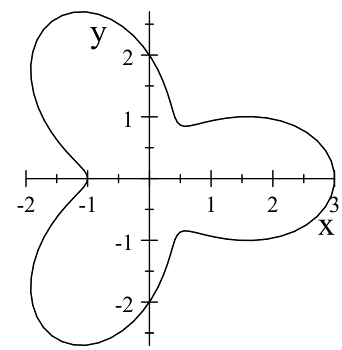
b. 12

c. 6

d. 4

e. 2

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



a. $r = 2 + \cos 3\theta$

b. $r = 2 - \cos 3\theta$

c. $r = 1 + 2\cos 3\theta$

d. $r = 1 - 2\cos 3\theta$

e. $r = 1 + \cos 3\theta$

6. In $\mathbb{R}^4$, find a vector perpendicular to the hyperplane containing the 4 points

$$P = (2,1,4,1), \quad Q = (-1,3,2,1), \quad R = (3,1,2,2) \quad \text{and} \quad S = (3,1,4,1)$$

a. $(-1,2,2,-4)$

b. $(1,2,2,4)$

c. $(0,2,2,4)$

d. $(1,-2,2,-4)$

e. $(0,-2,2,-4)$

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

a. 8

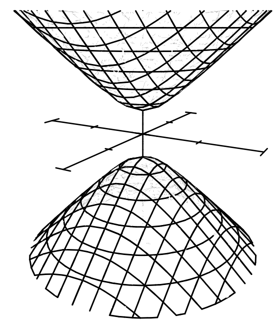
b. 6

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 $\vec{v}$

$\vec{v} =$ ____________________

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

$\vec{a} =$ ____________________

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

$\vec{j} =$ ____________________

d. (3 pts) speed $|\vec{v}|$ (Simplify!)
HINT: The quantity inside the square root is a perfect square.

$|\vec{v}| =$ ____________________

e. (3 pts) tangential acceleration a_T

$a_T =$ ____________________

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

$\hat{B} =$ ______________________________

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

$A = (2,6,3)$ $t =$ ___________

$B = (1,12,24)$ $t =$ ___________

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

$L =$ ________________________

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.)

$M =$ ____

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 $(1,12,24)$.

$W =$ ________________________

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