

Name _____ Date _____

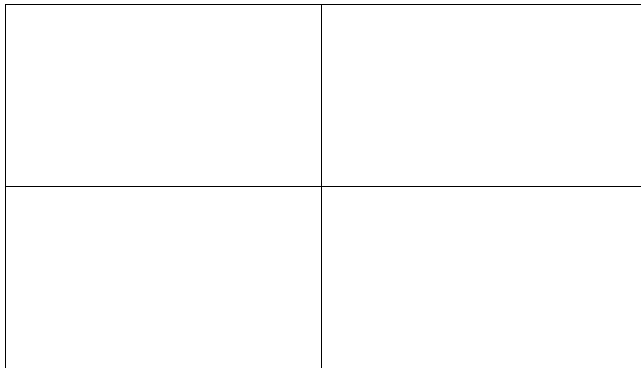
Instructions: Please show all of your work as partial credit will be given where appropriate, **and** there may be no credit given for problems where there is no work shown. All answers should be completely simplified, unless otherwise stated.

1. For $x=2t^2+1$ and $y=4t-5$ such that $-1 \leq t \leq 1$, do the following:

(a) (10 pts) Eliminate the parameter to obtain the corresponding Cartesian equation.

Answer 1(a): _____

(b) (10 pts) Graph the curve.



(c) (5 pts) Indicate if the curve is simple and/or closed.

Simple: T or F (circle one)

Closed: T or F (circle one)

2. (10 pts) Find the length of the curve given by $x = \cos t$ and $y = \ln(\sec t + \tan t) - \sin t$ for $0 \leq t \leq \frac{\pi}{4}$.

Answer 2: _____

3. (15 pts) For position vector given by $\mathbf{r}(t) = e^t \mathbf{i} + e^{-t} \mathbf{j} + 2t \mathbf{k}$, find the velocity and acceleration vectors and the speed at $t = \ln 2$.

$$\mathbf{v}(t) = \underline{\hspace{15cm}}$$

$$\mathbf{a}(t) = \underline{\hspace{15cm}}$$

$$\text{speed at } t = \ln 2 = \underline{\hspace{10cm}}$$

4. (10 pts) Find the limit, if it exists. $\lim_{t \rightarrow 0} \left[\frac{2t \sin t}{t^2} \mathbf{i} - \frac{4t^3}{t^2 - t} \mathbf{j} + \frac{\tan t}{\sin t} \mathbf{k} \right]$

Answer (4) : _____

5. (10 pts) Find the equation of the sphere that has the line segment joining $(-1, 4, 3)$ and $(3, 0, 5)$ as a diameter.

Radius = _____ units

center = _____

Eqn of sphere: _____

6. (10 pts each) Let $\mathbf{a} = \langle 2, -1, 1 \rangle$, $\mathbf{b} = \langle -3, -1, 4 \rangle$ and $\mathbf{c} = 5\mathbf{i} + 2\mathbf{j}$. Find each of the following.

(a) $2\mathbf{a} - 3\mathbf{c}$

$$2\mathbf{a} - 3\mathbf{c} = \underline{\hspace{10em}}$$

(b) $\mathbf{a} \cdot (\mathbf{b} + \mathbf{c})$

$$\mathbf{a} \cdot (\mathbf{b} + \mathbf{c}) = \underline{\hspace{10em}}$$

(c) $\mathbf{b} \cdot \mathbf{c} - |\mathbf{b}|$

$$\mathbf{b} \cdot \mathbf{c} - |\mathbf{b}| = \underline{\hspace{10em}}$$

(Note: This is # 6 continued.) $\mathbf{a} = \langle 2, -1, 1 \rangle$, $\mathbf{b} = \langle -3, -1, 4 \rangle$ and $\mathbf{c} = 5\mathbf{i} + 2\mathbf{j}$
(d) $\hat{\mathbf{c}}$ (the unit vector)

$$\hat{\mathbf{c}} = \underline{\hspace{10cm}}$$

(e) $\mathbf{a} \times (\mathbf{b} \times \mathbf{c})$

(f) $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$ $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) = \underline{\hspace{10cm}}$

$$\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c}) = \underline{\hspace{10cm}}$$

7. (10 pts each) For $\mathbf{a} = \mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$ and $\mathbf{b} = 2\mathbf{i} - \mathbf{k}$, find each of the following:
(a) Direction cosines for \mathbf{a} .

$$\cos \alpha = \underline{\hspace{4cm}}$$

$$\cos \beta = \underline{\hspace{4cm}}$$

$$\cos \gamma = \underline{\hspace{4cm}}$$

- (b) The angle θ between \mathbf{a} and \mathbf{b} . (Just write a simplified expression. If you don't have a calculator just write the numerical formula for the angle.)

(c) Find the projection of \mathbf{b} onto \mathbf{a} . $\theta = \underline{\hspace{4cm}}$

Projection of \mathbf{b} onto $\mathbf{a} = \underline{\hspace{4cm}}$

8. (10 pts each) For the planes given by $3x + y + z = 7$ and $5x + 3z = 13$, answer the following questions.

(a) Find the line of intersection between the planes and write that line in parametric equations.

Line: _____

(b) Find the equation of the plane that is perpendicular to the line of intersection and goes through the point $(2, 1, 3)$.

Equation of plane: _____

Extra Credit: (9 pts)

A luxury cruiseliner is traveling due west at only 8 miles per hour. A woman on the ship is running across the ship, heading due north, at 6 miles per hour. What are the magnitude and direction of her velocity relative to the surface of the water? (If you don't have a calculator, just give the angle in simplified form.)

velocity magnitude: _____

velocity direction: _____