

Calc III - 3450:223  
EXAM # 1 Fall197

NAME \_\_\_\_\_  
ROW \_\_\_\_\_

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| 100 Points |

Show **ALL** your work.

1. Given vectors **a**, **b**, and **c**, show using magnitudes and/or the dot product and/or the cross product how you would

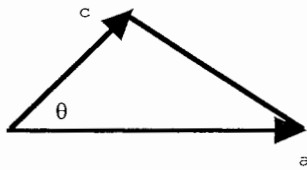
a) decide if **a** and **b** are parallel

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| 2 Points |

b) decide if **a** and **b** are orthogonal

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| 2 Points |

c) calculate the area of the triangle determined by **a** and **c**

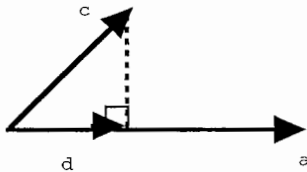


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| 2 Points |

d) calculate the angle  $\theta$

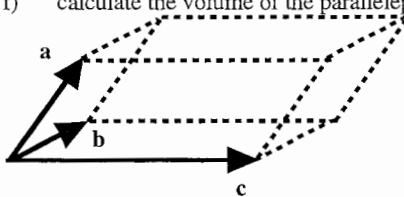
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| 2 Points |

e) find the vector **d**



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| 3 Points |

f) calculate the volume of the parallelepiped determined by **a**, **b**, and **c**.



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| 3 Points |

2. Identify the given surface and convert its equation to cylindrical coordinates:  $x^2 + y^2 = 2z$

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| 8 Points |

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| 22 Points |

3. The position of a projectile is given by  $\mathbf{r}(t) = 3 \sin(t) \mathbf{i} + 4t \mathbf{j} + 3 \cos(t) \mathbf{k}$ . Find the following:

a) The projectile's velocity,  $\mathbf{v}$

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| 2 Points |

b) The speed of the projectile

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| 2 Points |

c) The unit tangent vector,  $\mathbf{T}$

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| 2 Points |

d) The unit normal vector,  $\mathbf{N}$

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| 3 Points |

e) The curvature,  $\kappa$

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| 3 Points |

f) The acceleration of the projectile written in terms of  $\mathbf{T}$  and  $\mathbf{N}$ . You do not have to write out  $\mathbf{T}$  and  $\mathbf{N}$  in your answer.

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| 6 Points |

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| 18 Points |

4. Find an equation for the plane consisting of all points that are equidistant from the points  $(-4, 2, 1)$  and  $(2, -4, 3)$ .

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| 10 Points |

5. Find  $AC \times AD$  and  $AB \cdot (AC \times AD)$  given the points  $A(1,0,1)$ ,  $B(2,3,0)$ ,  $C(-1,1,4)$ , and  $D(0,3,2)$ .

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| 10 Points |

6. Find parametric equations for the line tangent to  $\mathbf{r}(t)$  at  $t = 1$  if  $\mathbf{r}'(t) = 6t \mathbf{i} - 2e^{2t} \mathbf{j} + \frac{1}{1+t} \mathbf{k}$  and  $\mathbf{r}(0) = 2 \mathbf{i} - \mathbf{j} + 4 \mathbf{k}$ .

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| 10 Points |

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| 30 Points |

7. Convert the following equation in spherical coordinates to one in rectangular coordinates and sketch its graph:  $\rho^2[\sin^2\phi \sin^2\theta + \cos^2\phi] = 9$ .

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| 10 Points |

8. Find the distance between the parallel planes  $10x + 2y - 2z = 5$  and  $5x + y - z = 1$ .

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| 10 Points |

9. A projectile is fired horizontally with initial speed of 500 m/s from a position 200 m above the ground. Determine the speed of the projectile when it hits the ground.

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| 10 Points |

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| 30 Points |