VCU

MATH 307

Multivariate Calculus

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Sample Test 1



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Name:			
Score: _			

Directions. Solve the following questions in the space provided. Unless noted otherwise, you must show your work to receive full credit. This is a closed-book, closednotes test. Calculators, computers, etc., are not used. Put a your final answer in a box, where appropriate.

6. (10 pts.) Suppose $f(x,y) = \frac{\sqrt{x-y}}{1-x^2-y^2}$. Sketch the domain of this function.

1. (24 points) Let $\mathbf{u} = \langle 2, -2, 3 \rangle$ and $\mathbf{v} = \langle 0, -2, 1 \rangle$.

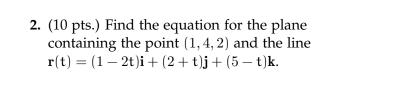
(a)
$$\mathbf{u} \cdot \mathbf{v} =$$

(b)
$$\mathbf{u} \times \mathbf{v} =$$

(c)
$$|u| =$$

(d)
$$|v| =$$

- (e) Find $\cos \theta$, where θ is the angle between \boldsymbol{u} and \boldsymbol{v} .
- (f) Find x, where 2x v = 3u.



- **3.** (16 pts.) Consider the triangle in space whose vertices are the points A(1,1,4), B(-1,3,3) and C(3,2,1).
 - (a) Find a vector normal to the plane that the triangle lies in.

(b) Find the area of the triangle ABC.

- **4.** (30 pts.)
 - (a) Find a (non-zero) vector orthogonal to $\mathbf{v} = \langle 5, 4, -7 \rangle$.

(b)
$$\int_{\pi/4}^{\pi} \langle \sin t, 1, \sin t \cos t \rangle dt =$$

(c) Compute the arc length of the helix $\mathbf{r}(t) = \langle t, \sin t, \cos t \rangle$ between t = 0 and $t = 4\pi$.

5. (10 pts.) An object moving in space has acceleration $\mathbf{a}(t) = \left\langle 1, \frac{t}{6}, 1 \right\rangle$ feet per second per second at time t seconds. Suppose that at time t=0 it is at the origin and has velocity vector $\langle 1, 1, 2 \rangle$. Find the velocity function $\mathbf{v}(t)$ and its position function $\mathbf{r}(t)$.