

Homework 1, Calc III

Due Feb 3rd, 2009

1. Solve the following integral

$$\int \frac{1}{\sqrt{1+x^2}} dx.$$

2. What are the projections of the point $(3, 5, 2)$ on the xy -, xz -, and yz -planes? Graph the point $(3, 5, 2)$ in three dimensional space and draw the rectangular box that has the origin at one corner and the point $(3, 5, 2)$ as the opposite vertex.

3. Determine if the following points lie on a straight line

(a) $A(2, 4, 2)$, $B(3, 7, -2)$, $C(1, 3, 3)$

(b) $D(4, -4, 0)$, $E(3, 5, 1)$, $F(0, 3, 6)$

4. Show that $x^2 + y^2 + z^2 - 6x + 3y + 8z - 15 = 0$ is the equation of a sphere, and find its center and radius.

5. Find the unit vector in the same direction as the given vector

(a) $8\vec{i} - 3\vec{j} + 7\vec{k}$

(b) $\langle -2, 6, 4 \rangle$.

6. (a) Draw the vectors $\vec{a} = \langle 3, 2 \rangle$, $\vec{b} = \langle 2, -1 \rangle$, and $\vec{c} = \langle 7, 1 \rangle$.

(b) Show by means of a sketch that there are scalars s and t such that $\vec{c} = s\vec{a} + t\vec{b}$.

(c) Use your sketch to approximate the values of s and t .

(d) Find the exact values of s and t .

7. Determine if the following vectors are orthogonal, parallel, or neither.

(a) $\vec{a} = \langle -5.3, 7 \rangle$, $\vec{b} = \langle 4, 2, 2 \rangle$.

(b) $\vec{a} = \langle 2, 6, -4 \rangle$, $\vec{b} = \langle -3, -9, 6 \rangle$.

8. For what values of b are the vectors $\langle -6, b, 2 \rangle$ and $\langle b, b^2, b \rangle$ orthogonal?

9. Find the scalar and vector projections of \vec{b} onto \vec{a}

(a) $\vec{a} = \langle 3, 6, 2 \rangle$, $\vec{b} = \langle 1, 2, 3 \rangle$.

(b) $\vec{a} = \langle 1, 1, 1 \rangle$, $\vec{b} = \langle 1, -1, 1 \rangle$

10. Find the cross product $\vec{a} \times \vec{b}$ and verify that it is orthogonal to both \vec{a} and \vec{b} .

(a) $\vec{a} = \langle 0, 1, 7 \rangle$, $\vec{b} = \langle 2, -1, 4 \rangle$.

(b) $\vec{a} = \langle 1, -1, -1 \rangle$, $\vec{b} = \langle 0.5, 1, 0.5 \rangle$.