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Section: 51

MATH 243 - Quiz 1

February 19, 2014

Please SHOW ALL YOUR WORK as partial credit may be given; note all relevant equations, ideas, theorems, sketches, etc., to show what you know. Simplify wherever possible to make your answer more compact and neat. (Otherwise, if your answer cannot be simplified then leave it as is.) DO NOT leave your answer as a complex fraction. Answers without justification will be heavily penalized.

1. (25 pts) Consider the position vector $\vec{r} = \langle x, y \rangle$. Describe the set of all points (x, y) such that $||\vec{r}|| > 5$.

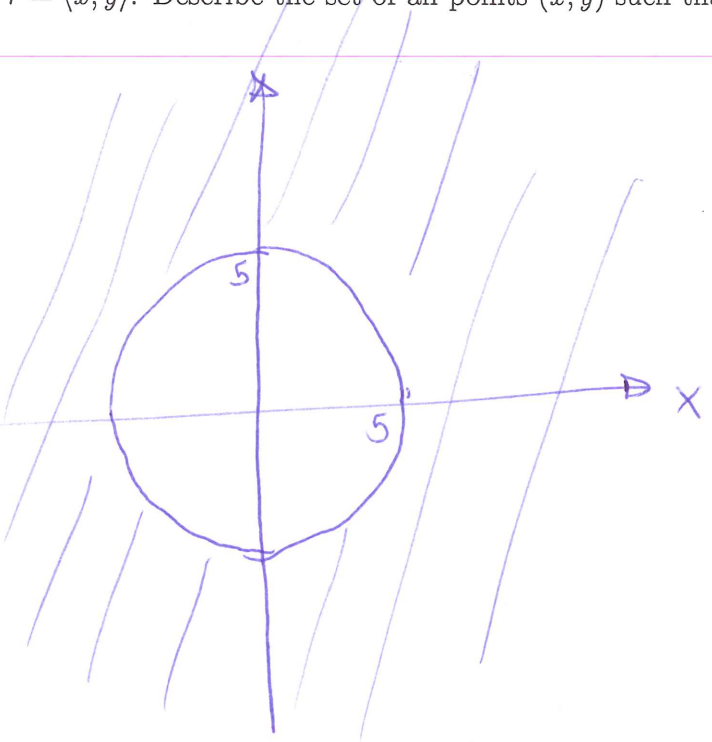
$||\vec{r}|| > 5$

$\sqrt{x^2+y^2} > 5$

$x^2+y^2 > 25$

The set of points outside the disk

$x^2+y^2 \leq 25$



2. (25 pts) If $\vec{u} = 6\hat{i} + 2\hat{j} - 3\hat{k}$, what should be the value of α if we need that $||\alpha\vec{u}|| = 21$?

Since $||\alpha\vec{v}|| = |\alpha|\,||\vec{v}||$ we have that

$$|\alpha| = \frac{||\alpha\vec{v}||}{||\vec{v}||} = \frac{21}{\sqrt{36+4+9}} = \frac{21}{7} = 3$$

$\therefore \alpha = \pm 3$

3. (25 pts) Determine the value of x such that the vectors $\vec{a} = \langle 1, 2, -3 \rangle$ and $\vec{b} = \langle x, 5, x \rangle$ are perpendicular.

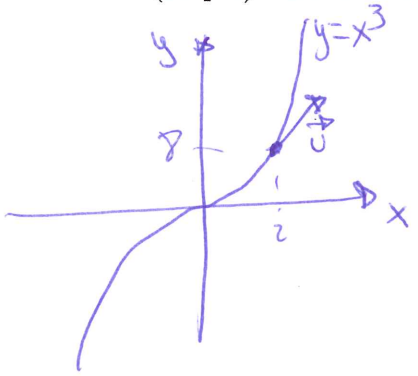
If $\vec{a}$ and $\vec{b}$ are perpendicular, then:

$\vec{a} \cdot \vec{b} = 0$

$\langle 1, 2, -3 \rangle \cdot \langle x, 5, x \rangle = x + 10 - 3x = -2x + 10 = 0$

$\Rightarrow x = 5$

4. (25 pts) Find a unit vector tangent to the graph of $y = x^3$ at the point $(2, 8)$.



$\vec{v} = \langle 1, f'(x) \rangle$

$\vec{v} = \langle 1, 3(2)^2 \rangle = \langle 1, 12 \rangle$

$\hat{v} = \dfrac{\langle 1, 12 \rangle}{\sqrt{145}} = \left\langle \dfrac{\pm 1}{\sqrt{145}}, \dfrac{\pm 12}{\sqrt{145}} \right\rangle$