

EXAM 1

Math 212, 2015-2016 Spring, Clark Bray.

You have 50 minutes.

No notes, no books, no calculators.

YOU MUST SHOW ALL WORK AND EXPLAIN ALL REASONING
TO RECEIVE CREDIT. CLARITY WILL BE CONSIDERED IN GRADING.

All answers must be simplified. All of the policies and guidelines
on the class webpages are in effect on this exam.

Good luck!

Name _____

“I have adhered to the Duke Community
Standard in completing this
examination.”

1. _____

2. _____

3. _____

4. _____

5. _____

Signature: _____

Total Score _____ (/100 points)

1. (20 pts)

- (a) Compute the area of the parallelogram with vertices at the points $(1, 3, 2)$, $(2, 4, 4)$, $(4, 4, 2)$, and $(5, 5, 4)$.

- (b) Show that if $\vec{v} \times \vec{w} \neq \vec{0}$, then the list \vec{v} , \vec{w} , $\vec{v} \times \vec{w}$ is in right hand order.

2. (20 pts) Find the equation of the plane that is parallel to and equidistant from the line L_1 parametrized by $\vec{x}(t) = (3 + 8t, 2 + 3t, 4t)$ and the line L_2 with symmetric equations

$$\frac{x-1}{4} = 4y+1 = z$$

3. (20 pts) A particle is moving such that its acceleration in terms of time t is

$$\vec{a}(t) = \begin{pmatrix} 4 \sin 2t \\ 9e^{3t} \\ 6t \end{pmatrix}$$

and the initial position and initial velocity are given by $\vec{x}_0 = (1, 2, 3)$ and $\vec{v}_0 = (4, 5, 6)$, respectively.

- (a) Find $\vec{x}(1)$.

- (b) Find $\kappa(0)$.

4. (20 pts) The function $g : \mathbb{R}^3 \rightarrow \mathbb{R}$ is given by $g(x, y, z) = (x^2 + y^2 + z)^2$.

(a) Draw/describe a representative level set of g .

(b) Find the unique function $f : \mathbb{R}^n \rightarrow \mathbb{R}^m$ whose graph is a level set of g , and indicate clearly the values of n and m .

5. (20 pts)

(a) Find the linear approximation of the function given by $f(x, y, z) = \sin(\pi(xe^y + z))$ at the point $\vec{a} = (1, 0, 2)$.

(b) Use the approximation above to estimate the value of $\sin(\pi(e^{0.02} + 2.03))$.