

27 January 2006

Name: \_\_\_\_\_

DIRECTIONS: Answer the following questions or execute the following commands below. You may NOT use a calculator. Remember, you are an attorney and I am a jury of 12 people. You must convince me beyond a reasonable doubt that your answers are correct by showing work and *writing neatly*. Should you have any questions, do not hesitate to ask them. There are questions on the back!

1. What is a rational function?

2. Let  $y = \ln x$ .

(a) Compute the curvature  $\kappa$  of the curve  $y$  at the point  $x$ .

(b) Suppose you wanted to find the point on the curve where the curvature is maximized. Explain *in detail* how you would find it. Use complete sentences.

3. Let  $\mathbf{u}$ ,  $\mathbf{v}$ , and  $\mathbf{w}$  be vectors, and let  $c$  be a constant (scalar). Which of the following make sense? For the ones that do not make sense, explain your reasoning as to *why* they do not.

(a)  $(|\mathbf{u}|\mathbf{v} \cdot \mathbf{w} + c)[(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}]$

(b)  $(|\mathbf{u}||\mathbf{v}||\mathbf{w}|)\mathbf{u} \times \mathbf{v} + c$

(c)  $(\mathbf{u} + \mathbf{v} + \mathbf{w}) \times [(\mathbf{u} \cdot \mathbf{v} + c)\mathbf{w} \times \mathbf{u}]$

4. If  $\mathbf{u} \times \mathbf{v} = \mathbf{0}$  and  $\mathbf{u} \cdot \mathbf{v} = 0$ , what can you conclude? Be explicit.