

Honors PreCalculus

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

Dr. Quattrin

Limits and Derivatives Test

CALCULATOR ALLOWED

Score \_\_\_\_\_

Round to 3 decimal places. Show all work.

1.  $\lim_{x \rightarrow 9} \frac{\sqrt{x-5} - 2}{x-9} =$

- a)  $\frac{1}{4}$       b)  $-\frac{1}{4}$       c) 1      d)  $4\sqrt{2}$       e) dne
- 

2. An equation of the line normal to the graph of  $y = 3x^4 + 5x^3 - 9x^2 - 6x + 4$  at the point where  $x = 0$  is

- a)  $6x + y = 4$       b)  $6x - y = -4$       c)  $4x + 4y = 2$   
d)  $x - 6y = -24$       e)  $x + 6y = 24$
- 

3. If  $f$  is a differentiable function such that  $f(3) = 8$  and  $f'(3) = 5$ , which of the following statements must be false?

- (a)  $\lim_{x \rightarrow 3} f(x) = 8$       (b)  $\lim_{x \rightarrow 3^+} f(x) = \lim_{x \rightarrow 3^-} f(x)$       (c)  $\lim_{x \rightarrow 3} \frac{f(x) - 8}{x - 3} = 5$   
(d)  $\lim_{h \rightarrow 0} \frac{f(3+h) - 5}{h} = 8$       (e)  $\lim_{x \rightarrow 3} f'(x) = 5$
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4. Find an equation of the tangent line to the curve  $f(x) = 4x^3 - 3x - 1$  at the point in the first quadrant where  $\frac{dy}{dx} = 45$ .

- (a)  $y = 25x - 5$       (b)  $y = 45x + 65$       (c)  $y = 45x - 65$   
(d)  $y = 65 - 45x$       (e)  $y = 65x - 45$
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5. At what point on the graph of  $y = -3x^2$  is the tangent parallel to the line  $5x + 2y = 7$ ?

- (a)  $\left(-\frac{5}{12}, -\frac{75}{144}\right)$       (b)  $\left(\frac{1}{15}, -\frac{3}{225}\right)$       (c)  $\left(\frac{5}{12}, -\frac{75}{144}\right)$   
(d)  $(5, 3)$       (e) None of these
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6. A particle moving in the  $xy$ -plane with its  $x$ -coordinate given by  $x(t) = \frac{1}{4}t^4 + \frac{2}{3}t^3 - \frac{3}{2}t^2 - 1$  and its  $y$ -coordinate given by  $y(t) = t^3 - 12t + 1$ . When is the particle moving up and left?

- (a)  $(-\infty, -3)$       (b)  $(-3, -2)$       (c)  $(-2, 0)$   
(d)  $(0, 2)$       (e)  $(2, \infty)$
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1. Use the equation of the line tangent to  $y = 6x^3 - 3x^2 + 5x - 4$  at  $x = -1$  to approximate  $f(-1.1)$

2. The motion of a particle is described by  $x(t) = 3t^4 - 16t^3 - 30t^2 + 240t - 140$ .
- a) When the particle is stopped?
  - b) Which direction it is moving at  $t = -1$ ?
  - c) Where is it when  $t = -1$ ?
  - d) Find  $a(-1)$ .

3. A particle's position  $\langle x(t), y(t) \rangle$  at time  $t$  is described by  $\langle t^3 - 6t^2 + 9t + 1, -t^2 + 6t + 2 \rangle$ .

a) Find the speed at  $t = 3$ .

b) When, if ever, is the particle stopped? Prove it.

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5. Set up, but do not solve, the limit definition of the derivative for

$$y = \sqrt[4]{x^5} + \frac{4}{x^3} - 2\sqrt[7]{x^9} - \pi^3$$

6. Use the Power Rule to find:

a)  $\frac{d}{dx} [7x^4 - x^3 + \pi + 42x] =$

b)  $D_x \left[ \sqrt[4]{x^5} + \frac{4}{x^3} - 2\sqrt[7]{x^9} - \pi^3 \right] =$

7. Evaluate the following limits:

(a)  $\lim_{x \rightarrow -1/2} \frac{8x^3 + 1}{4x^2 - 8x - 5}$

(b)  $\lim_{x \rightarrow -3} \sqrt{\frac{x^4 - 81}{x^3 + 2x^2 - 4x - 3}}$