Honors Precalculus
Ms Abrao
Limits and Derivatives Test
CALCULATOR ALLOWED

Name: KEY
Date:
Period:

Round to 3 decimal places.
Show all work.
Multiple Choice (3 pts.)

1. $\lim_{x\to1}\frac{\sqrt{x}-1}{x-1}=$ $\frac{0}{0} = \lim_{x\to1}\frac{\sqrt{x}-1}{x-1}\cdot\frac{\sqrt{x}+1}{\sqrt{x}+1} = \lim_{x\to1}\frac{\cancel{x-1}}{\cancel{(x-1)}[\sqrt{x}+1]} = \lim_{x\to1}\frac{1}{\sqrt{x}+1} = \frac{1}{2}$

(a) 0 (b) 1/2 (c) 1 (d) 3/2 (e) The limit does not exist.

2. Find the slope of the tangent line to the curve $y=x^2+2x$ at the point $(1,3)$.

(a) 10 (b) 8 (c) 6 (d) 4 (e) 3

$y' = 2x+2$
$y'|_{x=1} = 4$

3. If $f(x)=-x^3+x+\frac{1}{x}$, then $f'(-1)=$

(a) 3 (b) 1 (c) -1 (d) -3 (e) -5

$f(x) = -x^3+x+x^{-1}$
$f'(x) = -3x^2+1-x^{-2}$
$f'(-1) = -3+1-1$

Free Response (10 pts. each)

1. A particle's position $(x(t), y(t))$ at time t is described by the parametric equations $x(t) = 2t^2 + 5t - 12$, $y(t) = 2t^3 + t^2 - 13t + 6$. When is the particle moving right and down?

$x'(t) = 4t + 5$

c.v: $t = -5/4$

x': $-$ 0 $+$

t: $-5/4$

right

$y'(t) = 6t^2 + 2t - 13$

c.v: $t = 1.315, -1.648$

y': $+$ 0 $-$ 0 $+$

t: -1.648 $\quad$ 1.315

down

Particle moving right and down when $t \in (-1.25, 1.315)$

2. The motion of a particle is described by $x(t) = 4t^3 - 63t^2 + 86t - 14$.

(a) When is the particle stopped?
(b) Which direction is it moving at $t = 7$?
(c) Where is it at $t = 7$?
(d) Find $a(7)$.

ⓐ $v(t) = 12t^2 - 126t + 86 = 0$

$t = 9.766, .734$

Particle stopped @ $t = 9.766, .734$

ⓑ $v(7) = -208$ $\quad$ Particle is moving to the left.

ⓒ $x(7) = -1127$

ⓓ $a(t) = 24t - 126$

$a(7) = 42$

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Multiple Choice (3 pts.)

4. At what point on the graph of $y=\frac{1}{2}x^2$ is the tangent line parallel to the line $2x-4y=3$?

$2x-4y=3$ $\quad 4y=2x-3$ $\quad y=\frac{1}{2}x-\frac{3}{2}$ $\quad m=\frac{1}{2}$ $\quad y'=x=\frac{1}{2}$ $\quad \left(\frac{1}{2},\frac{1}{8}\right)$

(a) $\left(\frac{1}{2},-\frac{1}{2}\right)$ (b) $\left(\frac{1}{2},\frac{1}{8}\right)$ (c) $\left(1,-\frac{1}{4}\right)$ (d) $\left(1,\frac{1}{2}\right)$ (e) $(2,2)$

5. If $f(x)=\sqrt{x^2-1}$, which of the following is equivalent to $f'(3)$?

$f'(3)=\lim\limits_{x\to 3}\frac{f(x)-f(3)}{x-3}$

(a) $\cancel{\lim\limits_{x\to 3}\frac{\sqrt{(x+h)^2-1}-\sqrt{8}}{x-3}}$ (b) $\cancel{\lim\limits_{h\to 0}\frac{\sqrt{(x+h)^2-1}-\sqrt{x^2-1}}{h}}$

(c) $\cancel{\lim\limits_{h\to 0}\frac{\sqrt{(x+h)^2-1}-\sqrt{8}}{h}}$ (d) $\lim\limits_{x\to 3}\frac{\sqrt{x^2-1}-\sqrt{8}}{x-3}$ (e) $\cancel{\lim\limits_{h\to 0}\frac{\sqrt{x^2-1}-\sqrt{8}}{x-3}}$

6. A particle moves according to a law of motion $s=4t^3-9t^2+6t+2,\ t\geq 0$ where *s* is measured in feet and *t* in seconds. When is the particle at rest?

(a) $t=\frac{1}{2}$ (b) $t=1$ (c) $t=0$ (d) $t=\frac{1}{2},1$ (e) $t=1,0$

$S'=12t^2-18t+6=0$
$6(2t^2-3t+1)=0$
$6(2t-1)(t-1)=0$

Free Response (10 pts. each)

3. Set up, but do not solve, the LIMIT definition of the derivative for $f(x)=13x^3+3x+4021$.

$$f'(x)=\lim_{h\to 0}\frac{13(x+h)^3+3(x+h)+4021-13x^3-3x-4021}{h}$$

4. Find the following limits:

(a) $\lim_{x\to 2}\frac{\sqrt{x+2}-\sqrt{2x}}{x^2}$ $= \frac{\sqrt{4}-\sqrt{4}}{4} = 0$

(b) $\lim_{x\to 3}\frac{x^2-9}{x^2-2x-3}$ $= \lim_{x\to 3}\frac{\cancel{(x-3)}(x+3)}{\cancel{(x-3)}(x+1)} = \frac{6}{4} = \frac{3}{2}$

$$\begin{array}{r} {}^{3}16 \\ 15 \\ \hline 80 \\ 16 \\ \hline 240 \end{array}$$

5. $D_x\left[16x^{15}-18x^2+41x-e+2+\frac{3}{\sqrt{x^3}}+\frac{1}{x}\right]$

$= D_x\left[16x^{15}-18x^2+41x-e+2+3x^{-3/2}+x^{-1}\right]$

$= 240x^{14}-36x+41-\frac{9}{2}x^{-5/2}-x^{-2}$