PreCalculus Honors '15-16 Name: Solution Key
Dr. Quattrin
Radical Functions Test
CALCULATOR ALLOWED Score _____
Round to 3 decimal places. Show all work.

1. Let $f(x)$ be the function $f(x)=\sqrt{x+4}$. Using the tangent line approximation to the graph of $f(x)$ at x=0, estimate $f(0.04)$.

a. 2.01 b. 2.02 c. 2.03 d. 2.04 e. 2.05

$f' = \frac{1}{2}(x+4)^{-1/2}$ $f'(0) = \frac{1}{4}$ $y-2=\frac{1}{4}x$

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2. Given this sign pattern $\frac{dy}{dx}$ $\overset{+\ 0\quad 0\ -\ 0\ +\ 0\quad 0\ -}{\longleftarrow\quad -2\quad -\sqrt{2}\quad 0\quad \sqrt{2}\quad 2\quad \longrightarrow}$ x, at what value of x does f have a local minimum? SIGN GOES − +

(a) -2 (b) $-\sqrt{2}$ (c) $\sqrt{2}$ (d) All of these (e) None of these

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3. Gravel is being dumped from a conveyor belt at a rate of 35 ft^3/min and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always equal. How fast is the height of the pile increasing when the pile is 15ft high?

$V=\frac{\pi}{3}r^2h$ $r=\frac{1}{2}h$

a) 0.27 ft/min
b) 1.24 ft/min
c) 0.14 ft/min
d) 0.2 ft/min
e) 0.6 ft/min

$V=\frac{\pi}{12}h^3$

$\frac{dV}{dt}=\frac{\pi}{4}h^2\frac{dh}{dt} \rightarrow 35=\frac{\pi}{4}(15)^2\frac{dh}{dt}$

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4. If $f(x)=(x^2-2x-1)^{2/3}$, then $f'(0)=$ $\frac{2}{3}(x^2-2x-1)^{-1/3}(2x-2)\Big|_{x=0}$

a) $\frac{4}{3}$ b) 0 c) $-\frac{2}{3}$ d) $-\frac{4}{3}$ e) -2

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5. For what values of x does the curve $y^2-x^3-15x^2=8$ have horizontal tangent lines?

$2y\frac{dy}{dx}-3x^2-30x=0$

$\frac{dy}{dx}=\frac{3x^2+30x}{2y}$

$=\frac{3x(x+10)}{2y}=0$

a) $x=-10$ only
b) $x=0$ only
c) $x=10$ only
d) $x=0$ and $x=-10$
e) $x=-10$, $x=0$, and $x=10$

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6. Given the functions $f(x)$ and $g(x)$ that are both continuous and differentiable, and that have values given on the table below.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
2	4	-2	8	1
4	2	8	2	3
8	8	-12	2	4

Given that $h(x)=g(f(x))$, $h'(4)=$ $g'(f(4)) \cdot f'(4) = g'(2) \cdot f'(4)$
$= 1 \cdot 8$

a) -6 b) -2 c) -1 d) 8 e) 24

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7. Find the absolute maximum value of $y=\sqrt{36-x^2}$ on the interval $x\in[-2, 2]$.

a) 5 b) 6 c) 7 d) 0 e) 1

$\frac{dy}{dx} = \frac{1}{2}(36-x^2)^{-1/2}(-2x)$
$= \frac{-x}{\sqrt{36-x^2}}$

$\frac{dy}{dx} = 0 \Rightarrow x = 0$

$\frac{dy}{dx}$ DNE $\Rightarrow x = \pm 6$

ENDS $\rightarrow x = \pm 2$

DNE + 0 − DNE

$-6 \quad 0 \quad 6$

Max

$y(0) = 6$

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Radical Functions Practice Test -- CALCULATOR ALLOWED
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1. Find the zeros and Domain of $y=\sqrt{x^5-11x^3+18x}$. Show the algebraic work to support the zeros ~~and critical values~~.

$x(x^4-11x^2+18)$
$x(x^2-9)(x^2-2)$

Zeros: $(\pm 3, 0)\ (\pm\sqrt{2}, 0)\ (0, 0)$

Domain:

$x \in [-3, -\sqrt{2}] \cup [0, \sqrt{2}] \cup [3, \infty)$

y^2 : $-\ 0\ +\ 0\ -\ 0\ +\ 0\ -\ 0\ +$
x : $-3\quad -\sqrt{2}\quad 0\quad \sqrt{2}\quad 3$

2. Find the Extreme Points of $y=\sqrt{x^5-11x^3+18x}$. Show the algebraic work to support the zeros and critical values.

Extreme Points: $(\pm 3, 0)\ (0, 0)\ (\pm\sqrt{2}, 0)\ (-\sqrt{6}, 5.422)\ (.775, 3.018)$

$$\frac{dy}{dx} = \frac{1}{2}(x^5-11x^3+18x)^{-1/2}(5x^4-33x^2+18)$$

i) $\frac{dy}{dx}=0$: $5x^4-33x^2+18=0 \rightarrow x^2 = \frac{33 \pm \sqrt{33^2-4(5)(18)}}{2(5)} = \begin{cases} 6 \\ .6 \end{cases}$

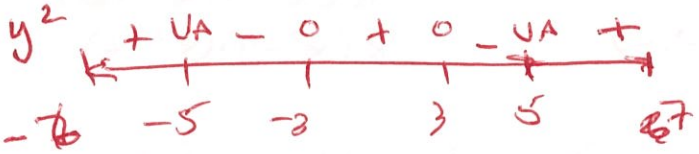
$x = \pm\sqrt{6}, \pm .775 \rightarrow$ IN DOMAIN $x = -\sqrt{6}, .775$

ii) $\frac{dy}{dx}$ DNE ~~$x=\pm 3, 0$~~ $x = \pm 3, \pm\sqrt{2}, 0$

3. Find the zeros, VAs, and domain of $y=\sqrt{\frac{x^2-9}{x^2-25}}$ on $x\in[-6,7]$. Show the Algebra that supports your answer.

Zeros: $(\pm 3, 0)$ VAs: $x=\pm 5$

Domain: $x\in[-6,-5)\cup[-3,3]\cup(5,7]$



4. Find the Extreme Points of $y=\sqrt{\frac{x^2-9}{x^2-25}}$ on $x\in[-6,7]$. Show the Algebra that supports your answer.

Extreme Points: $(\pm 3, 0)$, $(0, \frac{3}{5})$, $(-6, \frac{27}{11})$ $+1.567$ $(7, \frac{40}{24})$ 1.291

$$\frac{dy}{dx}=\frac{1}{2}\left(\frac{x^2-9}{x^2-25}\right)^{-1/2}\left[\frac{(x^2-25)(2x)-(x^2-9)(2x)}{(x^2-25)^2}\right]=\frac{-16x}{(x^2-9)^{1/2}(x^2-25)^{3/2}}$$

i) $\frac{dy}{dx}=0 \rightarrow x=0$

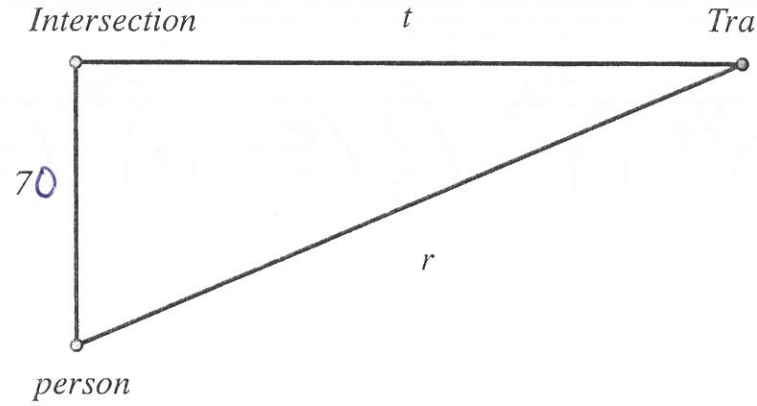
ii) $\frac{dy}{dx}$ DNE $\rightarrow x=\pm 3, \pm 5$ BUT IN DOMAIN $x=\pm 3$

iii) $x=-6, 7$

6. The airspeed velocity of a European swallow unladen by coconuts is given by the equation $V = A_0\sqrt{\left[\left(\frac{Q_C}{P_0}+1\right)^{2/7}-1\right]}$ where A_0 is the speed of sound, P_0 is the air pressure and Q_C is a function of the number of beats per minute of the swallow's wings. What is the equation for the acceleration of said swallow?

$$V' = A_0 \frac{1}{2}\left(\left(\frac{Q_c}{P_0}+1\right)^{2/7}-1\right)^{-1/2}\left(\frac{2}{7}\left(\frac{Q_c}{P_0}+1\right)^{-5/7}\left(\frac{1}{P_0}Q'\right)\right)$$

5. A railroad track and a road cross at right angles. An observer stands on the road 70 meters south of the intersection and watches an eastbound train traveling at 60 m/sec. At how many m/sec is the train moving away from the observer 4 seconds after it passes the intersection?



$t = 240$ AT 4 SECONDS

$r = 250$

$$\frac{d}{dt}\left[7^2 + t^2 = r^2\right]$$

$$0 + 2t\frac{dt}{dt} = 2r\frac{dr}{dt}$$

$$240(60) = 250\frac{dr}{dt}$$

$$\frac{dr}{dt} = 57.6\ \frac{M}{Sec}$$

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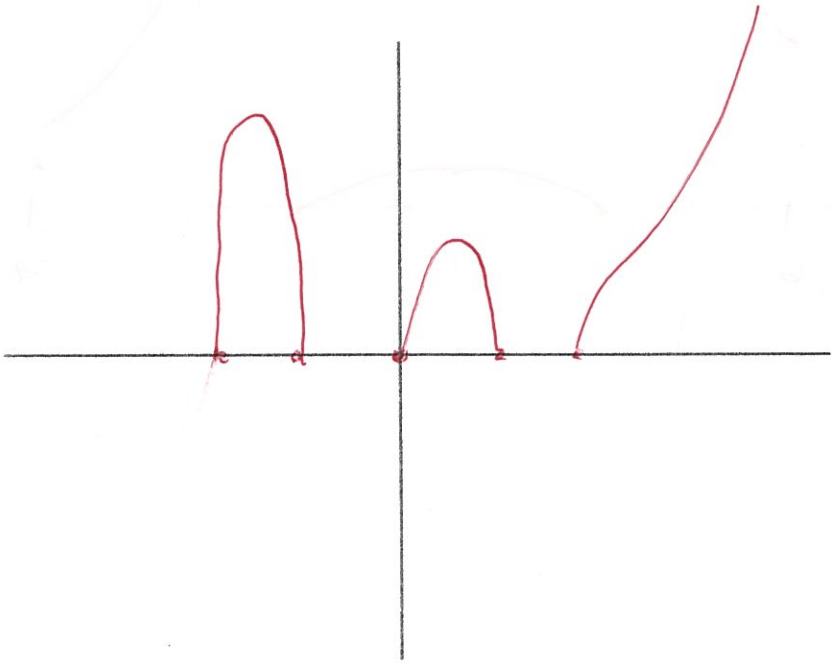
7. Find the traits and **sketch** $y=\sqrt{x^5-11x^3+18x}$.

Domain: SEE #1 Range: $y \in [0, \infty)$

Y – Int: $(0,0)$

Zeros: SEE #1 Extreme Points: SEE #2

End Behavior (Left): NONE End Behavior (Right): UP



8. List the traits and **sketch** of $y=\sqrt{\dfrac{x^2-9}{x^2-25}}$ on $x\in[-6,7]$.

Domain: See #3

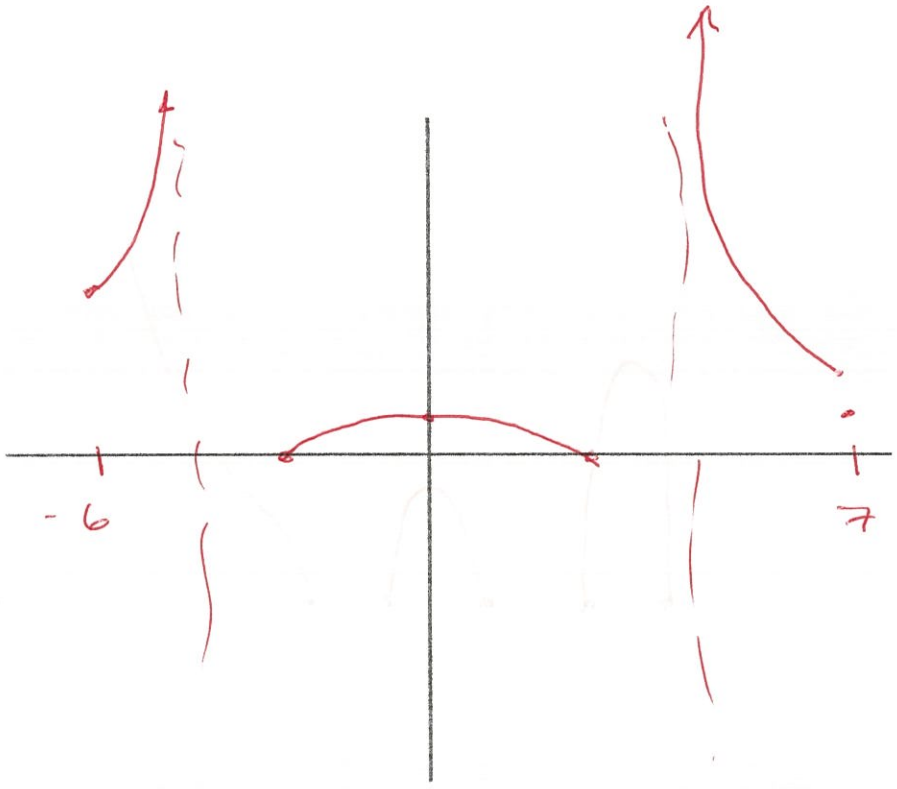
Range: $y\in[0,\frac{3}{5}]\cup[\frac{5}{3},\infty)$

Y – Int: $(0,\frac{3}{5})$

VAs: $x=\pm5$

Zeros: See #3

Extreme Points: See #4

End Behavior (Left): NONE

End Behavior (Right): NONE