Honors PreCalculus '22-23
Dr. Quattrin
Polynomials Test v2
CALCULATOR ALLOWED

Name: Solution Key

Score _____

1. Given this sign pattern

$f'(x)$	$-$	0	$+$	0	$+$
x		-3		1	

, at what value(s) of x does f has a minimum value?

a) -3 b) 1 c) 2 d) -1 and 3 e) none of these

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2. The minimum value of $f(x) = \dfrac{4}{\sqrt{x}} + 3\sqrt{x}$ is

$f' = \dfrac{-4}{x^{3/2}} + \dfrac{3}{2x^{1/2}} = \dfrac{-4+3x}{2x^{3/2}}$

a) $\dfrac{4}{3}$ b) $\dfrac{3}{4}$ c) $\dfrac{19\sqrt{3}}{2}$ d) $4\sqrt{3}$

DNE $-$ 0 $+$
0 $4/3$
MIN

e) There is no minimum value

$y(4/3) = 4\sqrt{3}$

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3. What are all values of x for which the function $f(x) = 2 - 12x - 2x^2 + \dfrac{1}{3}x^3$ is increasing?

$f' = -12 - 4x + x^2$

$= (x+2)(x-6)$

a) $-2 \le x \le 6$
b) $-6 \le x \le 2$
c) $x \le -2$ or $6 \le x$
d) $x \le -6$ or $2 \le x$
e) All real numbers

f'	$+$	0	$-$	0	$+$
x		-2		6	

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4. Suppose $f'(x)=(1-x)^3(3-x)^5(x-5)^2$. Of the following, which best describes the graph of $f(x)$?

NO CHANGE

f' + 0 − 0 + 0 +

MAX 1 3 5

a) $f(x)$ has relative minimum at $x=1$, a relative maximum at $x=3$, and neither at $x=5$

b) $f(x)$ has relative minimum at $x=3$, a relative maximum at $x=1$, and neither at $x=5$

c) $f(x)$ has relative minimum at $x=5$, a relative maximum at $x=3$, and neither at $x=1$

d) $f(x)$ has relative minimum at $x=1$, a relative maximum at $x=5$, and neither at $x=3$

e) $f(x)$ has relative minimum at $x=3$, a relative maximum at $x=5$, and neither at $x=1$

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5. Consider a particle moving such that its position is described by the function $x(t)=6t^2-t^4$. When does the particle attain its maximum velocity?

a) $t=0$ b) $t=1$ c) $t=2$

d) $t=-1$ e) $t=\pm 1$

$V=12t-4t^3$

$V'=12-12t^2=0$

$t=\pm 1$

V' − 0 + 0 −

t −1 1

MAX

6. Find the x-value of the absolute maximum of $y = x^2 - 2x - 8$ on $x \in [-2, 3]$.

a) $x = -1$ b) $x = 1$ c) $x = 2$

d) $x = 3$ e) $x = 4$

$y' = 2x - 2 = 0$

$x = 1$

x	y
-2	0
1	-9
3	-5

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7. Given this sign pattern

$f'(x)$	$-$	0	$-$	0	$+$
x		-3		1	

, on which interval(s) is $f(x)$ decreasing?

a) $-3 \le x \le 1$
b) $-3 \le x$
c) $x \le -3$
d) $1 \le x$
e) $x \le 1$

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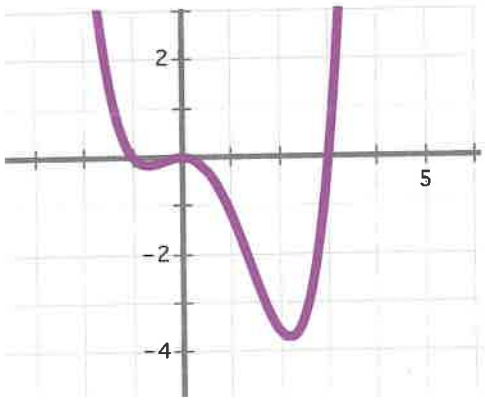
8. Which of the following equations matches this graph:



a) $y = .3(x^4 - 2x^3 - 3x^2)$

$.3(x^2(x^2 - 2x - 3))$

b) $y = .3(x^4 - 3x^3)$

c) $y = .3(3x^3 - x^4)$

OPENS DOWN

d) $y = -.02(x+2)(x-1)(x-4)^3$ $-x^5$

4.6: GRAPHING WITH SIGN PATTERNS

SIGNS OF $\frac{dy}{dx}$ → INCREASING & DECREASING

CHANGE FROM + TO − → MAX
" " − TO + → MIN
NO CHANGE → NO EXTREME

} 1ST DERIVATIVE TEST.

CRIT VALUES: i) $\frac{dy}{dx} = 0$

ii) $\frac{dy}{dx}$ DNE (DENOM = 0) → THE FUNCTION IS VERTICAL OR NOT SMOOTH.

iii) ENDPOINTS ON A GIVEN DOMAIN.

SIGNS OF THE 2ND D_x → CONCAVE UP VS CONCAVE DOWN

SIGN CHANGE → POINT OF INFLECTION

END POINTS CANNOT BE POIS

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Polynomials Test-- CALCULATOR ALLOWED

Round to 3 decimal places. Score _____

Show all work.

1. Find the zeros of $y = x^3 - 3x^2 - 45x + 135$. Show the algebraic support.

$y = x^2(x-3) - 45(x-3)$

$= (x^2 - 45)(x-3)$

$(\pm 3\sqrt{5}, 0)$ $(3, 0)$

2. Find the extreme points of $y = x^3 - 3x^2 - 45x + 135$. Show the algebraic work to support critical values.

$\frac{dy}{dx} = 3x^2 - 6x - 45$

i) $3x^2 - 6x - 45 = 0$

$x^2 - 2x - 15 = 0$

$(x-5)(x+3) = 0$ $x = 5, -3$

ii) NONE

iii) NONE

$(-3, 216)$

$(5, -40)$

3. Find the zeros ~~and extreme points of~~ $y = x^3 - 3x^4$ on $x \in [-2, 5]$. Show the algebraic support.

$$y = x^3(1 - 3x)$$

$$x = 0, \ 1/3$$

$(0, 0)$

$(1/3, 0)$

4. Find the ~~zeros and~~ extreme points of $y = x^3 - 3x^4$ on $x \in [-2, 5]$. Show the algebraic work to support critical values.

$$\frac{dy}{dx} = 3x^2 - 12x^3 = 3x^2(1 - 4x)$$

i) $\frac{dy}{dx} = 0 \rightarrow x = \cancel{0}, \ 1/4$ $\quad \left(1/4, \frac{1}{256}\right)$

ii) NONE $\quad (-2, -40)$

iii) $x = -2, 5$ $\quad (5, -1750)$

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Polynomials Test—CALCULATOR NOT ALLOWED

Show all work. Score _____

5. The sign pattern for the derivative of $H(x)$ is given. (a) Is $x = -2$ at a maximum, a minimum, or neither? Why? (b) Is $x = 1/4$ at a maximum, a minimum, or neither? Why?

$H'(x)$	+	0	+	0	−	0	+
x		-2		$1/4$		7	

a) NEITHER; THE SIGN OF H' DOES NOT CHANGE

b) MAXIMUM BECAUSE THE SIGN OF H' SWITCHES FROM POSITIVE TO NEGATIVE

6. Find the traits and sketch $y = x^3 - 3x^4$ on $x \in [-2, 5]$.

Domain: $x \in [-2, 5]$

Range: $y \in [-1750, 1/28]$

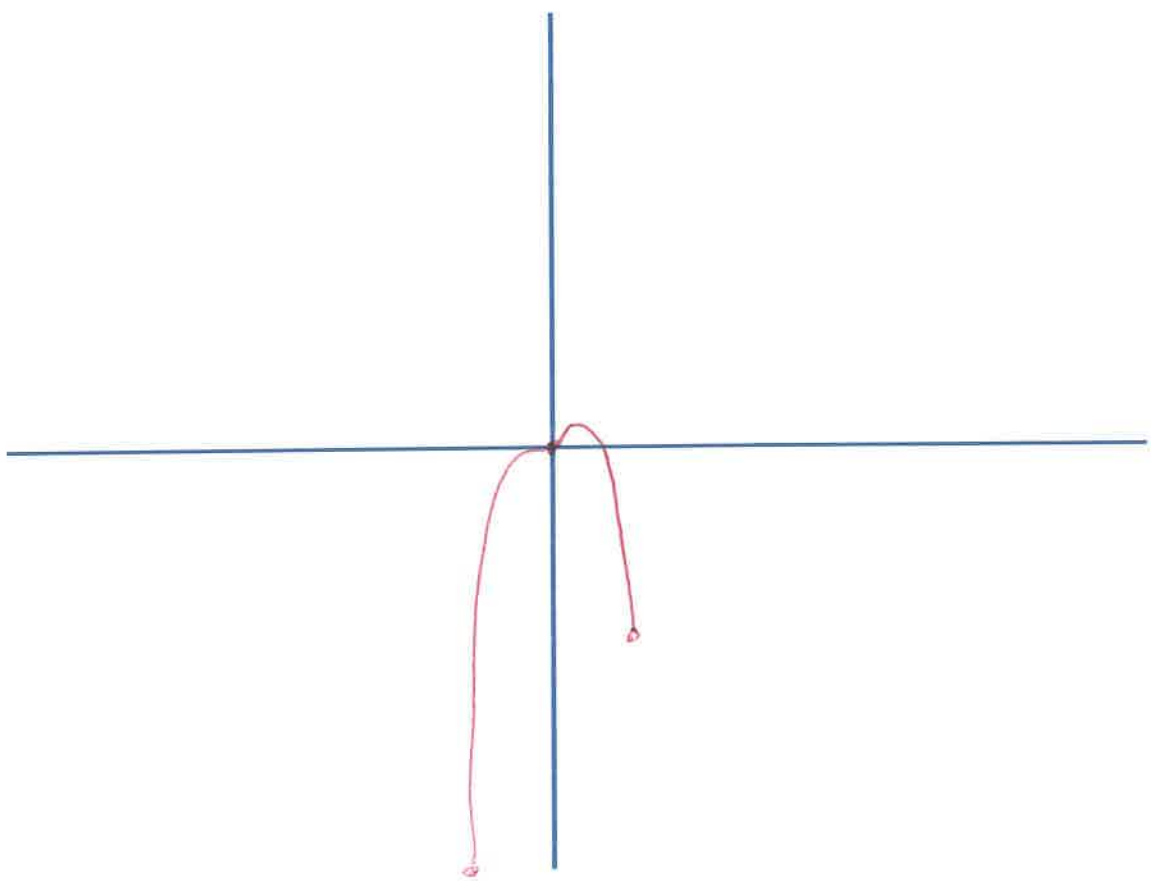
Zeros: $(0,0)$ $(1/3, 0)$

Y – Int: $(0,0)$

End Behavior (left): NONE

End Behavior (right): NONE

Extreme Points: SEE #4



7. Find the traits and sketch of $y = x^3 - 3x^2 - 45x + 135$.

Domain: $x \in$ ALL REALS

Range: $y \in$ ALL REALS

Zeros: $(\pm 3\sqrt{5}, 0)$ $(3, 0)$

Y – Int: $(0, 135)$

End Behavior (left): DOWN

End Behavior (right): UP

Extreme Points: SEE #2