_____ / 60 total points (both parts)

Test #1 (Part 1, No Calculator)
Math 160, Prof. Beydler

Name: ______________________________

Thursday, September 27, 2018

Directions: Show all work. No calculator, books, or notes. Your desk and lap must be clear (no phones, no smart watches, etc.). If you have a phone in your lap or on your chair, it is considered cheating, and you will receive a zero on this test. Write your answers in the indicated places, or box your answers. When you're finished with Part 1, please turn it in, take a bathroom break, get your calculator out, and start Part 2. Good luck!

1. (3 points) Suppose $f(x) = \sqrt{2x+1}$. Find $\frac{f(x+h)-f(x)}{h}$ and simplify by canceling the factor of h.

Answer: $\frac{f(x+h)-f(x)}{h} = \dfrac{2}{\sqrt{2(x+h)+1}+\sqrt{2x+1}}$

$$\frac{f(x+h)-f(x)}{h} = \frac{\left(\sqrt{2(x+h)+1}-\sqrt{2x+1}\right)\cdot\left(\sqrt{2(x+h)+1}+\sqrt{2x+1}\right)}{(h)\cdot\left(\sqrt{2(x+h)+1}+\sqrt{2x+1}\right)}$$

$$= \frac{2(x+h)+1-(2x+1)}{h\left(\sqrt{2(x+h)+1}+\sqrt{2x+1}\right)}$$

$$= \frac{\cancel{2x}+2h+\cancel{1}-\cancel{2x}-\cancel{1}}{h\left(\sqrt{2(x+h)+1}+\sqrt{2x+1}\right)}$$

$$= \frac{2\cancel{h}}{\cancel{h}\left(\sqrt{2(x+h)+1}+\sqrt{2x+1}\right)}$$

2. (1 point) Find the domain of $f(x) = \frac{\sqrt{x-2}}{x-3}$.

Need: $x-2 \geq 0$ and $x-3 \neq 0$

$x \geq 2$ and $x \neq 3$

Answer: $[2,3) \cup (3,\infty)$

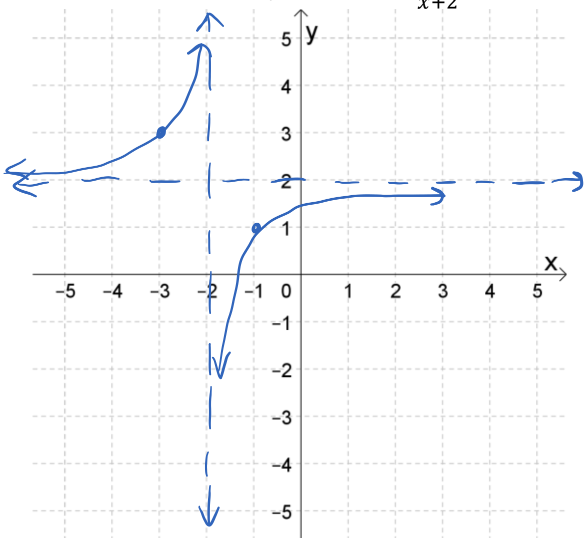
OR $\{x \mid x \geq 2 \text{ and } x \neq 3\}$

3. (1 point) Determine whether $f(x) = x^3 + 2x$ is even, odd, or neither. Be sure to show how you got your answer by the definition of even/odd.

Circle one: even odd neither

$$f(-x) = (-x)^3 + 2(-x)$$
$$= -x^3 - 2x$$
$$= -(x^3+2x)$$
$$= -f(x)$$

4. (2 points) Graph $f(x) = 2 - \frac{1}{x+2}$. Be sure to describe the transformations to the basic function.



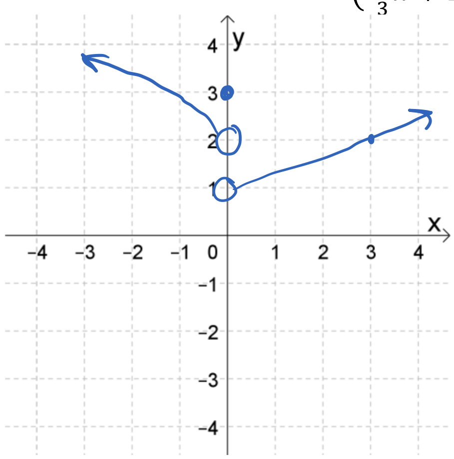
$\frac{1}{x}$

$\frac{1}{x+2}$ Shift left 2

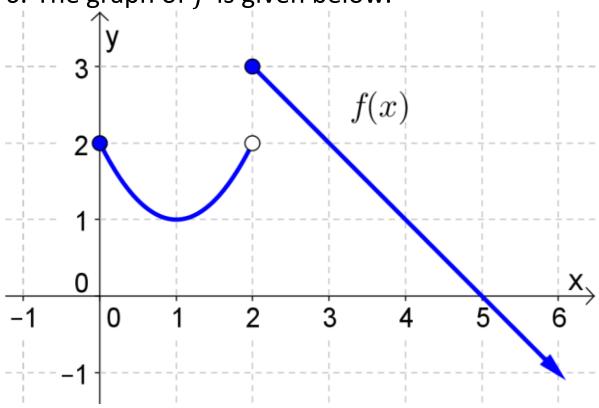
$-\frac{1}{x+2}$ Reflect about x-axis

$2-\frac{1}{x+2}$ Shift up 2

5. (3 points) Graph $g(x) = \begin{cases} \sqrt{-x}+2 & \text{if } x < 0 \\ 3 & \text{if } x = 0 \\ \frac{1}{3}x+1 & \text{if } x > 0 \end{cases}$



6. The graph of f is given below.



a) (2 points) Determine the intervals on which f is increasing and decreasing.

Increasing: $[1, 2]$

Decreasing: $[0, 1], [2, \infty)$

b) (2 points) Find all local maxima and minima. Write your answers in the form $f(123) = 456$.

Local maxima: $f(0) = 2,\ f(2) = 3$ (Note: $f(0)=2$ optional)

Local minima: $f(1) = 1$

c) (1 point) Find the absolute maximum and absolute minimum of f, or write "none" if none. Write your answers in the form $f(123) = 456$.

Absolute maximum: $f(2) = 3$ Absolute minimum: none

d) (1 point) Find the domain of f. Domain: $[0, \infty)$

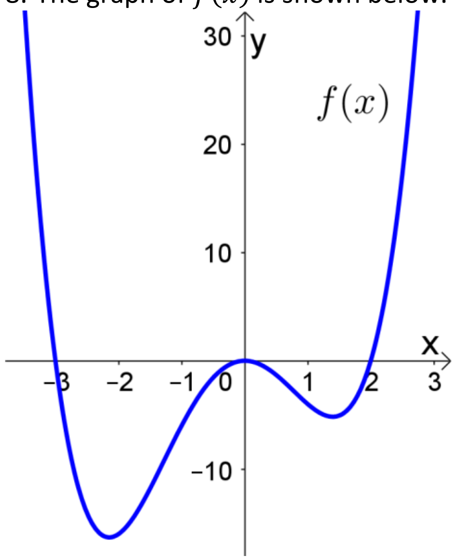
e) (1 point) Find the range of f. Range: $(-\infty, 3]$

7. (2 points) Divide using long division: $\frac{2x^5 - x^4 - 4x^2 - 2x + 3}{x^3 + 2x - 1}$

Answer: $\frac{2x^5 - x^4 - 4x^2 - 2x + 3}{x^3 + 2x - 1} = 2x^2 - x - 4 + \frac{5x-1}{x^3+2x-1}$

$$
\begin{array}{r}
2x^2 - x - 4 \\
x^3 + 2x - 1 \enclose{longdiv}{2x^5 - x^4 + 0x^3 - 4x^2 - 2x + 3} \\
-(2x^5 \qquad + 4x^3 - 2x^2) \\
\hline
-x^4 - 4x^3 - 2x^2 - 2x + 3 \\
-(-x^4 \qquad - 2x^2 + x) \\
\hline
-4x^3 \qquad - 3x + 3 \\
-(-4x^3 \qquad - 8x + 4) \\
\hline
5x - 1
\end{array}
$$

8. The graph of $f(x)$ is shown below.



a) (1.5 points) Find the zeros of f, and for each zero determine if the multiplicity is even or odd.

Answer: -3 (odd), 0 (even), 2 (odd)

b) (1 point) How many turning points does f have? Turning points: 3

c) (1 point) What is the smallest possible degree of f? Smallest possible degree: 4

d) (1 point) Determine the end behavior of f.

As $x \to \infty$, $f(x) \to$ ∞

As $x \to -\infty$, $f(x) \to$ ∞

9. (2 points) Find the slant asymptote of $g(x) = \frac{x^3-2x^2+6x-15}{x^2+4}$.

Slant asymptote: $y =$ $x-2$

$$
\begin{array}{r}
x-2 \\
x^2+4 \,\overline{\big)\, x^3-2x^2+6x-15} \\
-(x^3 \qquad +4x) \\
\hline
-2x^2+2x-15 \\
-(-2x^2 \qquad -8) \\
\hline
2x-7
\end{array}
$$

10. (1 point) Fill in the blank: The Remainder Theorem say that if a polynomial $P(x)$ is divided by $x-c$, then the remainder is the value $P(c)$.