MAC 1140, Fall 2017.

Exam #1

September 25, 2017

Name key

- You will be told when to begin the work and when to terminate work on the examination. You must stop when instructed. Points may be deducted in case of violations.
- Please show your work to support your answers that require calculations. Correct but unsupported answers may not be given full credit.
- The use of a cell phone or other electronic communication devices during the examination is not allowed. The exam will be canceled and a grade of "0" will be assigned to anyone who uses a cell phone during the examination or if one is found within hands reach.
- Calculators are not allowed on this exam.
- The exam consist of two parts. Part I contains four multiple choice questions worth 5 points each. Part II contains 8 open ended questions worth 10 points each if not stated otherwise.

Part I

Choose your answer from five available choices. No partial credit will be given for wrong answers.

1. What is $(f \circ g)(x) = f(g(x))$ if $f(x) = \dfrac{2}{x+4}$ and $g(x) = \sqrt{3x-2}$

   (a) $\dfrac{2}{\sqrt{3x-2}+4}$

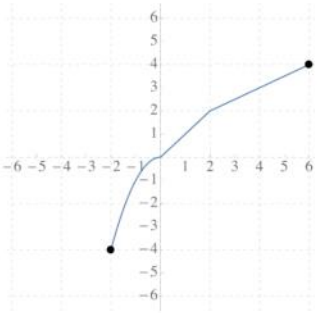
   (b) $\dfrac{2\sqrt{3x-2}}{x+4}$

   (c) $\dfrac{2}{\sqrt{3x-2}+4}$

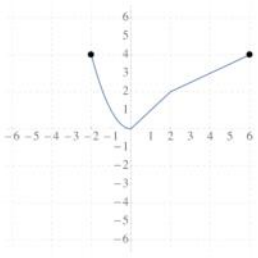
   (d) $\sqrt{3\dfrac{2}{x+4}-2}$

   (e) None of the above

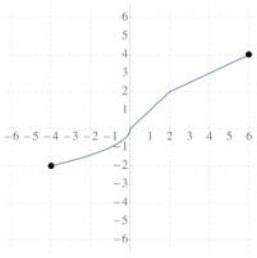
2. The graph of a one-to-one function f is given below. Which of the following is the graph of its inverse?



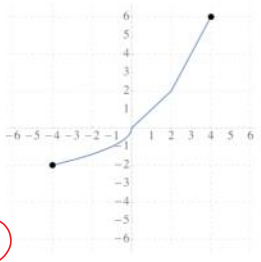
(a)



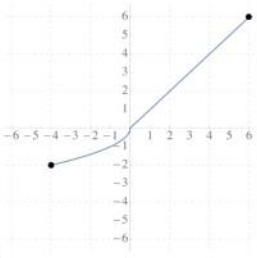
(b)



(c)



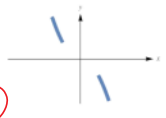
(d)



(e) None of the above.

3. Which of the following illustrates the end behavior of $f(x) = -2x^5 + 3x^3 - x + 2$

(a) 

(b) 

(c) 

(d) 

4. Find the domain of $f(x) = \dfrac{3-x}{\sqrt{x+2}}$

$x+2 \geq 0$ and $\sqrt{x+2} \neq 0$

$x \geq -2$ $\quad x+2 \neq 0$

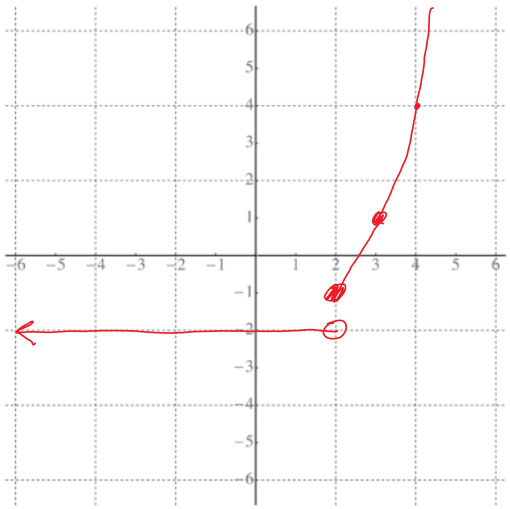
$x \neq -2$

$x > -2$

(a) $[-2, \infty)$
(b) $(-2, \infty)$
(c) $(-\infty, -2)$
(d) $(-2, 3) \cup (3, \infty)$
(e) None of the above.

Part II

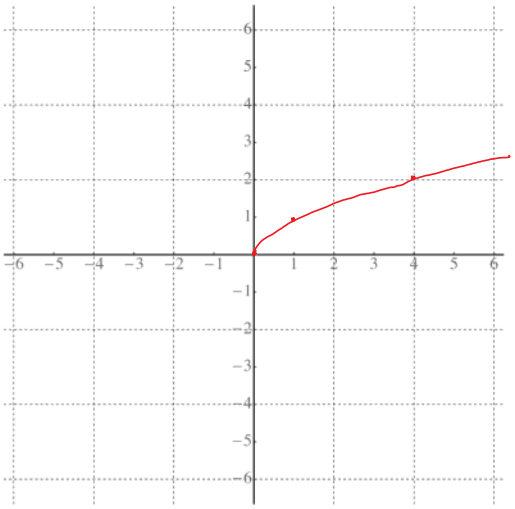
5. Graph the function $f(x) = \begin{cases} -2 & , x < 2 \\ 2x - 5 & , 2 \leq x \leq 3 \\ (x-2)^2 & x > 3 \end{cases}$



6. Graph $y = 3\sqrt{-x-2}$ using transformations. Start with the graph of a basic function – **plot accurately as least three points** and use them to perform transformations. Do one transformation at a time. Name the transformation and write the equation of the resulting function.

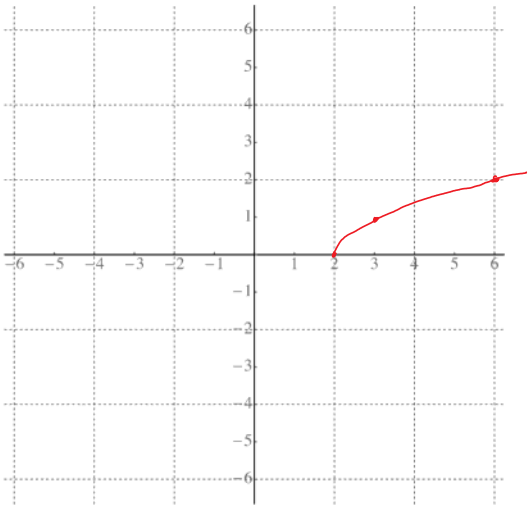
(i) Basic function:

y= $\sqrt{x}$



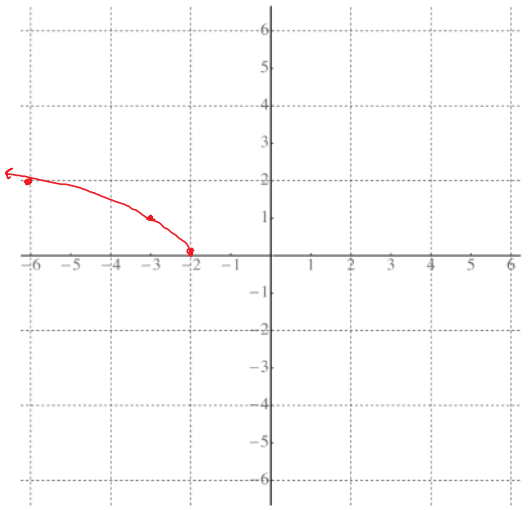
(ii) transformation: hor. shift to right by 2

y= $\sqrt{x-2}$



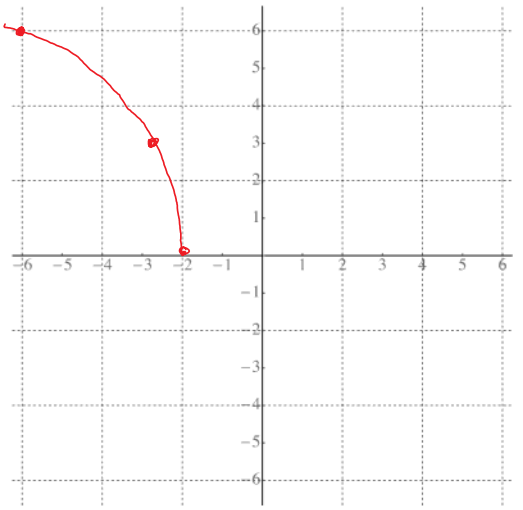
(iii) transformation: reflection about y-axis

y= $\sqrt{-x-2}$



(iv) transformation: vertical stretch by factor of 3

y= $3\sqrt{-x-2}$



7. Find the difference quotient for $f(x) = 2x^2 - 3x$.

$$\frac{f(x+h)-f(x)}{h} = \frac{2(x+h)^2-3(x+h)-(2x^2-3x)}{h}$$

$$= \frac{2x^2+4xh+2h^2-3x-3h-2x^2+3x}{h} = \frac{4xh+2h^2-3h}{h} = \frac{h(4x+2h-3)}{h}$$

$$= \boxed{4x-3+2h}$$

8. (20 points) Let $f(x) = 1 + 2\sqrt{3-x}$

(a) Find the domain of f.

$3-x \geq 0$

$3 \geq x$

$\boxed{(-\infty, 3]}$

(b) Find the inverse of f.

$x = 1+2\sqrt{3-y}$

$x-1 = 2\sqrt{3-y}$

$\frac{x-1}{2} = \sqrt{3-y}$

$\left(\frac{x-1}{2}\right)^2 = 3-y$

$\left(\frac{x-1}{2}\right)^2 - 3 = -y$

$y = 3 - \left(\frac{x-1}{2}\right)^2$

$\boxed{f^{-1}(x) = 3-\left(\frac{x-1}{2}\right)^2}$

Domain: $[1, \infty)$

9. Find the zeros and their multiplicities and sketch the graph of the following polynomial.

$$y = 2(x^2+2)(x-3)(x+6)^2$$

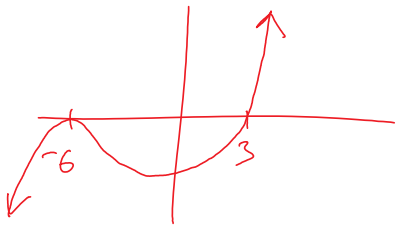
$x^2+2=0$
$x^2=-1$
no solution

$x-3=0$
$x=3$

$x+6=0$
$x=-6$

zero	multiplicity
3	1
-6	2

degree: 5
leading coeff: 2



10. Find $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$ and its domain if $f(x) = \frac{2}{x}$ and $g(x) = \frac{x+2}{1-x}$

$$\frac{f(x)}{g(x)} = \frac{\frac{2}{x}}{\frac{x+2}{1-x}} = \frac{2}{x}\cdot\frac{1-x}{x+2} = \boxed{\frac{2(1-x)}{x(x+2)}}$$

$x \neq 1, 0, -2$

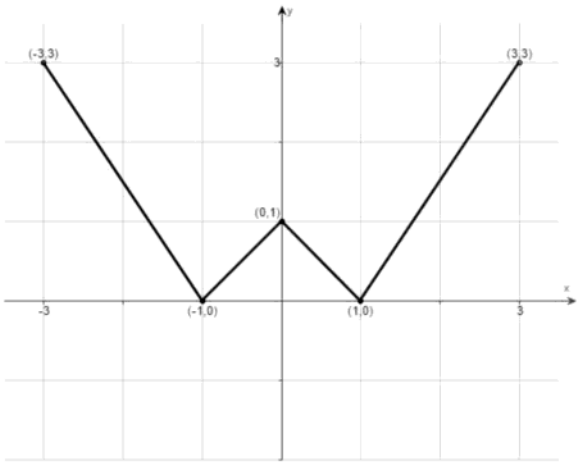
Domain: $(-\infty,-2)\cup(-2,0)\cup(0,1)\cup(1,\infty)$

11. Find two functions $f(x)$ and $g(x)$ (neither of them identity) so that $h(x) = f(g(x))$, where

$$h(x) = \frac{1}{2\sqrt{3x+1}}$$

$g(x) = \sqrt{x+1}$ | $g(x) = x+1$
$f(x) = \frac{3}{2x}$ | $f(x) = \frac{3}{2\sqrt{x}}$

12. Using the given graph of the function f, answer the parts (a)-(f) below.



(a) Find the domain of f. Express it in interval notation.

$[-3, 3]$

(b) Find the range of f. Express it in interval notation.

$[0, 3]$

(c) Find the $x-$intercepts.

$(-1, 0)$, $(1, 0)$

(d) Find the $y-$intercepts.

$(0, 1)$

(e) Find the intervals on which f is increasing.

$(-1, 0)$ and $(1, 3)$

(f) Find the intervals on which f is decreasing.

$(-3, -1)$ and $(0, 1)$