Name: Soln.

Math 1240 Spring 2020 Exam 1

Please write your only your name on this cover sheet.
All work will be written on a separate sheet of paper.
Unsupported and illegible answers will not receive credit.
Show all your work. No Work, No Credit. No Calculators.
All solutions and answers will be in exact form.

1. Simplify the expression into the form of $a + bi$
$\frac{2+i}{1-2i} + \frac{1+i}{5} - 1.$

2. Given the function, $f(x) = \frac{\sqrt{x}}{x+3}$ and $g(x) = x - 1$.
   (a) Find $(f \circ g)(x)$ and its domain
   (b) Evaluate $(f \circ g)(3)$

3. Given the function, $f(x) = -3x^2 + 4x - 1$
   (a) Find the net change from $x = -1$ to $x = 2$.
   (b) Find the average rate of change from $x = -1$ to $x = 2$.

4. Given the function, $g(x) = (x+1)^3 + 4$.
   (a) Label(function) and graph each transformation separately.
   (b) On each graph please label 2 or more points.

5. Given the function, $g(x) = \frac{3x-2}{2x+5}$
   (a) Find the domain and range of $g(x)$.
   (b) Determine the xy-intercepts.
   (c) Is $g(x)$ a function? Is $g(x)$ 1-1?, if so then go to the next part.
   (d) Find the inverse function.

6. A rectangular box has a square base. Its height is twice the width of the base. Find the following things:
   (a) Draw a picture of the box and label what the unknowns variables are.
   (b) Find the model of the function its volume V in terms of its width.

7. Given the piecewise function,
$$f(x) = \begin{cases} 1 - x^2, & x < 1 \\ 3x - 2, & x > 1 \end{cases}$$
   (a) Graph the $f(x)$ and label 3 points or more on the graph.
   (b) Is the function continuous from what you have drawn?
   (c) Evaluate the following $f(1)$, $f(-2)$, and $f(3)$.

Soln 1240 E1

1. $\frac{2+i}{1-2i} + \frac{1+i}{5} - 1$

$= \frac{(2+i)(1+2i)}{5} + \frac{-4+i}{5}$

$= \frac{2+4i+i-2}{5} + \frac{-4+i}{5}$

$= -\frac{4}{5} + \frac{6i}{5}$

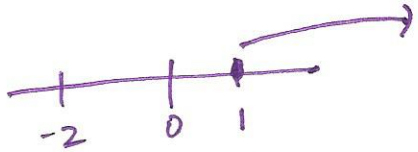
2. $f(x) = \frac{\sqrt{x}}{x+3}$ $g(x) = x-1$

a) $f(g(x))$

$= f(x-1)$

$= \frac{\sqrt{x-1}}{x+2}$

- D:



D: $\{x \mid x \geq 1\}$

b) $f(g(3))$

$= f(2)$

$= \frac{\sqrt{2}}{5}$

#3. $f(x) = -3x^2 + 4x - 1$

a) $NC = f(2) - f(-1)$

$= (-3(4) + 8 - 1) - (-3 - 4 - 1)$

$= -12 + 8 + 3 + 4$

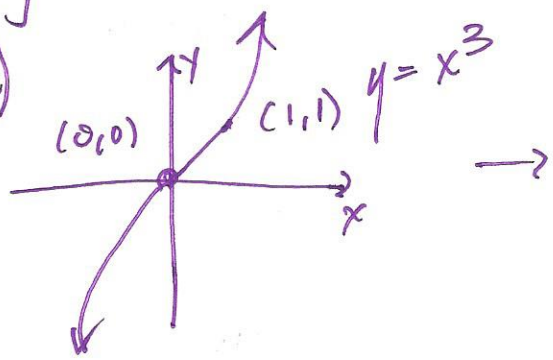
$= 3$

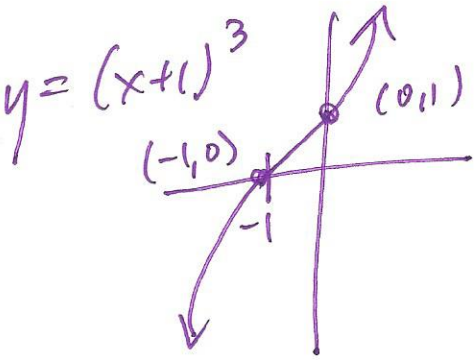
b) $ARC = \dfrac{f(2) - f(-1)}{2 + 1}$

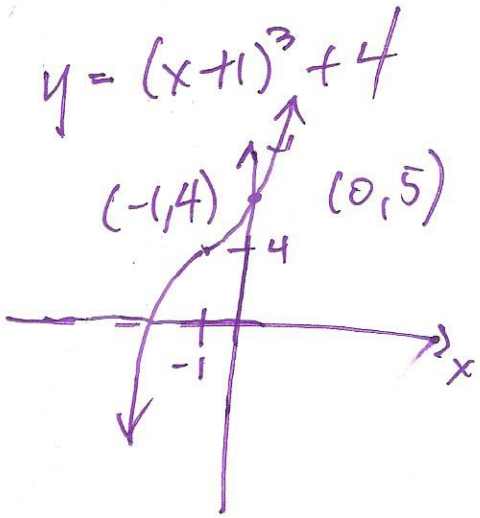
$= 1$

#4. $g(x) = (x+1)^3 + 4$

a)







#5. $g(x) = \frac{3x-2}{2x+5}$

a) D: $(-\infty, -\frac{5}{2}) \cup (-\frac{5}{2}, \infty)$

R: $(-\infty, \frac{3}{2}) \cup (\frac{3}{2}, \infty)$

b) y-int $= -\frac{2}{5}$ x-int $= \frac{2}{3}$

c) $g(x)$ is a fn? yes

$g(x)$ is 1-1? yes

d) $y = \frac{3x-2}{2x+5}$

$x = \frac{3y-2}{2y+5}$

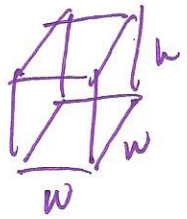
$2xy + 5x = 3y - 2$

$2xy - 3y = -2 - 5x$

$y = \frac{-2-5x}{2x-3}$

$g^{-1}(x) = \frac{-2-5x}{2x-3}$

#6.

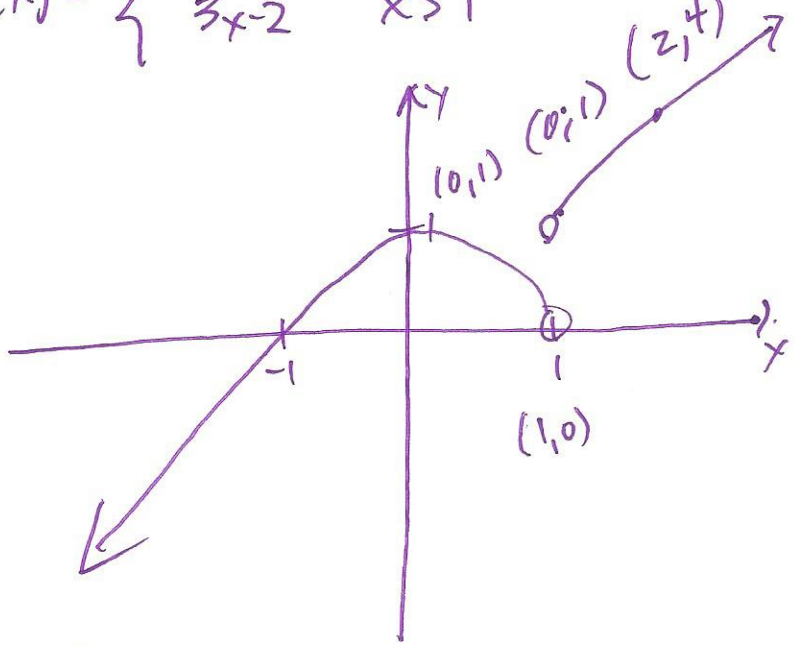


a) let w = width
h = height
rect. box w/ sq base.

let h = 2w
ℓ = length = w

b) Vol = ℓ · w · h
= w² h
= w² (2w)
= 2w³

#7. $f(x) = \begin{cases} 1-x^2 & x<1 \\ 3x-2 & x>1 \end{cases}$



b) No

c) f(1) = DNE
f(-2) = -3
f(3) = 7