

1. (30 points) Evaluate the following limits and simplify your answers. If a limit does not exist, clearly state this. If you use a theorem, clearly state its name and show that its hypotheses are satisfied.

(Reminder: You may not use L'Hopital's Rule in any solutions on this exam.)

(a) $\lim_{x \rightarrow 1} \frac{3 - \sqrt{6 + 3x}}{x - 1}$

(b) $\lim_{x \rightarrow 1} \frac{(x - 2)|x - 1|}{x^2 - 3x + 2}$

(c) $\lim_{x \rightarrow 0} x^2 \cos\left(\frac{1}{x^2}\right).$

2. (22 points) Answer each of the following problems. (a) and (b) are unrelated to one another.

(a) Let $f(\theta) = 6 \cos(2\theta) - 1$.

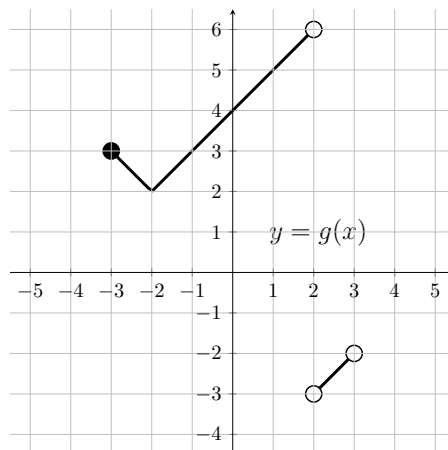
i. What is the range of f ? Write your final answer in interval notation.

ii. Solve the inequality $f(\theta) > 2$ for θ in the interval $[0, \pi]$. Write your final answer in interval notation.

(b) Suppose $\cos t = \frac{3}{7}$ and $\sin t < 0$. Find $\sin(2t)$.

3. (14 points) Use the table of values of $r(x)$ and the graph of $y = g(x)$ provided here to answer each of the problems below. Assume that $r(x)$ is continuous for all real numbers. Also assume that the entire graph of $y = g(x)$ is represented in the graph below. No justifications are required for this problem.

x	0	1	2	3	4	5
$r(x)$	3	-2	4	3	1	0



- (a) State the domain of $g(x)$ using interval notation.
- (b) State the range of $g(x)$ using interval notation.
- (c) Determine the value of $(g \circ r)(1)$.
- (d) Determine the value of $(r \circ g)(1)$.
- (e) Assuming $r(x)$ is an odd function, evaluate $r(-2)$.
- (f) Evaluate $\lim_{x \rightarrow 2^-} g(x)$, if it exists. (If it does not exist, state Does Not Exist.)
- (g) Evaluate $\lim_{x \rightarrow 1} (g \circ r)(x)$, if it exists. (If it does not exist, state Does Not Exist.)

4. (20 points) Consider the following function in terms of constant a :

$$f(x) = \begin{cases} \frac{x^2 - 4}{x - 2}, & \text{if } x < 2 \\ ax^2 - 5x, & \text{if } x \geq 2 \end{cases}$$

- (a) If $a = 3$, what type of discontinuity does f have at $x = 2$? (Justify your answer with the appropriate limit(s).)
- (b) Determine all values of a such that $f(x)$ is continuous at $x = 2$. (Justify your answer with the definition of continuity.)
5. (14 points) Consider $h(x) = \frac{x + 30}{x + 2}$ and $j(x) = x + \frac{1}{x}$.

- (a) Is $h(x)$ even, odd, or neither? Justify your answer.
- (b) State the domain of $h(x)$ in interval notation.
- (c) Determine $(h \circ j)(x)$ and give its domain in interval notation. (Your expression for $(h \circ j)(x)$ should be fully simplified with no fractions inside fractions.)