Answer all questions to the best of your ability. Full credit will only be given if all work is shown and organized and it is clear what your answer is. The exam is out of 100 points.

1. The force $F$ of wind on a flat surface positioned at a right angle to the direction of the wind varies jointly with the area $A$ of the surface and the square of the speed $v$ of the wind. A wind of 30 miles per hour blowing on a window measuring 4 feet by 5 feet has a force of 150 pounds. Find the variation constant $k$ and write the general formula. Use the general formula to find the force on a window measuring 3 feet by 4 feet with a wind of 50 miles per hour. Hint: \( \frac{150}{18000} = \frac{1}{120} \).

\[
F = \text{force of wind} \quad A = \text{Area} \quad v = \text{speed of wind} \quad k = \frac{150}{18000} = \frac{1}{120} \quad F = kA \sqrt{v^2}
\]

\[
= \frac{150}{18000} \cdot 30 \cdot 40 \cdot 900 = \frac{150}{18000} \cdot 120 = 150 \quad \text{general equation is} \quad F = \frac{k}{120} A \sqrt{v^2}
\]

if $A = 3 \cdot 4 = 12$, $v = 50$ then $F = \frac{1}{120} \cdot 12 \cdot 50^2 = \frac{1}{120} \cdot 2500 = 250$

2. What is the domain of the function $f(x) = \frac{(x-2)\sqrt{3-x}}{(3-x)(x+4)}$?

\[
3-x \geq 0 \implies 3 \geq x \implies x \leq 3
\]

\[
\text{dom}(f) = \{x \in \mathbb{R} : x \leq 3, x \neq 3, x \neq -4, \text{ } 3 \}
\]

3. Does the following relation define a function? Why or why not? \{(2, 3), (3, 0), (4, -2), (0, 3), (2, -2)\}

No, 2 maps to both 3 and -2.
4. If \( f(x) = \frac{2x}{x-2} \) answer the following questions:

(a) Is the point \( \left( \frac{1}{2}, -\frac{2}{3} \right) \) on the graph of \( f \)?
\[
f\left( \frac{1}{2} \right) = \frac{2 \cdot \frac{1}{2}}{\frac{1}{2} - 2} = \frac{1}{-\frac{3}{2}} = -\frac{2}{3}
\]
\( y \neq -\frac{2}{3} \)

(b) If \( x = 4 \), what is \( f(x) \)? What is the corresponding point on the graph?
\[
f(4) = \frac{2 \cdot 4}{4 - 2} = 4 = 0 \quad (4, 0) \quad \text{is on the graph}
\]

(c) If \( f(x) = 1 \), what is \( x \)? What point(s) are on the graph of \( f \)?
\[
f(x) = 1 \quad \Rightarrow \quad \frac{2x}{x^2} = 1 \quad \Rightarrow \quad 2x = x - 2 \quad \Rightarrow \quad x = -2 \quad \text{and} \quad (-2, 1)
\]

(d) What is the domain of \( f \)?
\[
\text{dom}(f) = \mathbb{R} \setminus \{ 2 \}
\]

(e) List the \( x \)-intercepts, if any, of the graph of \( f \).
\[
f(x) = 0 \quad \Rightarrow \quad \frac{2x}{x^2} = 0 \quad \Rightarrow \quad 2x = 0 \quad \Rightarrow \quad x = 0
\]

(f) List the \( y \)-intercept, if there is one, of the graph of \( f \).
\[
f(0) = 0 \quad \Rightarrow \quad y = 0
\]

5. Is \( f(x) = -3x^2 + 2x - 4 \) even, odd or neither?
\[
f(-x) = -3(-x)^2 + 2(-x) - 4 = -3x^2 - 2x - 4 \neq \frac{-f(x)}{f(x)}
\]
\( \Rightarrow \) Neither
6. Answer the following questions using the graph of the function given below:

(a) Where is the function increasing? $\text{inc. on } (-\infty, -2), \left(\frac{1}{2}, \infty\right)$

(b) Where is the function decreasing? $\text{dec. on } (-2, \frac{1}{2})$

(c) At what $x$ value(s) does the local maximum(s) occur? What is the corresponding maximum value(s)? $\text{local max at } x = -2, \text{ with value } 5$

(d) Answer problem (c) about local minimums. $\text{local min at } x = \frac{1}{2}, \text{ with value } -2$

(e) Are there absolute maximums or minimums? $\text{No abs max or min}$

(f) Where are the $x$ intercepts? $x\text{-int: } x = -3, -1, 2$

(g) We don't know exactly what the $y$ intercept is but we know that it must be between which two numbers? $y\text{-int is between } 0 \text{ and } -2$
7. If \( f(x) = \begin{cases} \frac{1}{x} & \text{if } x < 0 \\ \sqrt{x} & \text{if } x \geq 0 \end{cases} \)

(a) What is the domain of the function? \( \text{dom}(f) = \text{all reals} \)

(b) Locate any intercepts of the function. \( f(0) = 0 \) \( y \)-int \( a + \gamma = 0 \)
\( f(x) = 0 \) \( \Rightarrow \) \( x = 0 \) \( \Rightarrow \) \( x \)-int \( a + \gamma = 0 \)

(c) Sketch the graph of the function.

(d) Based on the graph what is the range? \( \text{range}(f) = \text{all reals} \leq 5 \)

8. Using \( f(x) = |x| \) use translations and reflections to obtain the graph of the function \( g(x) = |x - 1| + 2 \). Make sure you graph the original function \( f \) and show the graphs at each step with at least 3 labeled points.