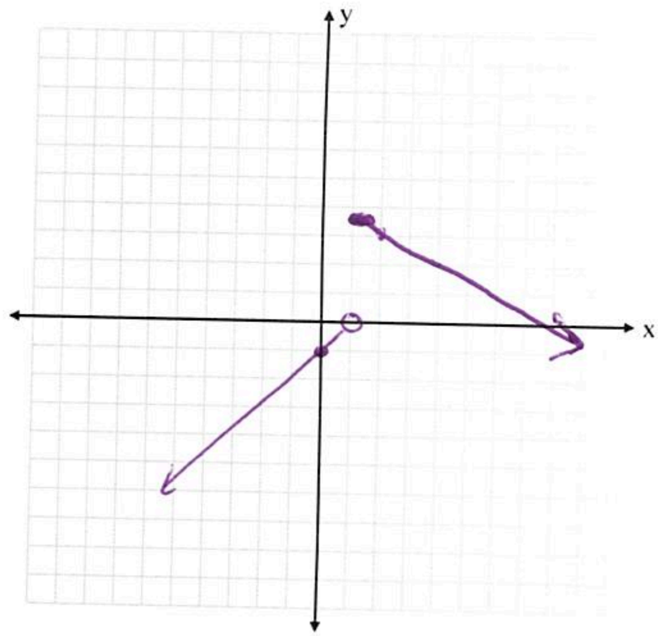
MTH 161, Quiz #2, Fall 2024 Name KEY

**Instructions**: Show all work. Use exact answers unless otherwise asked to round.

1. Sketch the graph of the function $f(x) = \begin{cases} x - 1, & x < 1 \\ -\frac{1}{2}x + 4, & x \geq 1 \end{cases}$




2. For the function above, find the following:
   a. Any symmetry of the function.

   none

   b. The intervals on which the graph is increasing, decreasing or constant.

   increasing $(-\infty; 1)$ decreasing $(1, \infty)$

   c. Any relative maxima or minima.

   max at $(1, 7/2)$ no min

   d. The domain and range.

   D: $(-\infty, \infty)$ all reals

   R: $\{-\infty, 7/2]$

3. Consider the function $f(x) = x^2 + 6x + 1$. Find $f(x+1)$.

$$f(x+1) = (x+1)^2 + 6(x+1) + 1 =$$
$$x^2 + 2x + 1 + 6x + 6 + 1 =$$
$$x^2 + 8x + 8$$

4. State the domain and range of the following functions. Write your answers in interval notation.

   a. $f(x) = \frac{x}{2x-3}$

   $2x-3=0$
   $2x=3$
   $x=3/2$

   D: $(-\infty, 3/2) \cup (3/2, \infty)$ $x \neq 3/2$

   R: $(-\infty, 1/2) \cup (1/2, \infty)$ $y = 1/2$ is HA

   b. $g(x) = \sqrt{4x+7} + 1$

   D: $[7/4, \infty)$

   R: $[1, \infty)$

   $4x+7 \geq 0$
   $4x \geq 7$
   $x \geq 7/4$

5. Consider the functions $f(x) = 4x - 1$ and $g(x) = x^2 + 3$. Find the following:

   a. $(f+g)(3)$

   $(f+g)(\cancel{x}) = 4x - 1 + x^2 + 3 = x^2 + 4x + 2$ $(f+g)(3) = 3^2 + 4(3) + 2 =$
   $9 + 12 + 2 = 21+$
   $= 23$

   b. $(fg)(x)$

   $(4x-1)(x^2+3) = 4x^3 + 12x - x^2 - 3 =$
   $4x^3 - x^2 + 12x - 3$

   c. $\left(\frac{g}{f}\right)(x)$

   $\frac{x^2+3}{4x-1}$

6. Find and simplify the difference quotient for $f(x) = 4x^2 - 7x + 5$. Recall the difference quotient is $\frac{f(x+h)-f(x)}{h}$.

$(x+h)^2 =$
$x^2+2xh+h^2$

$$\frac{4(x+h)^2 - 7(x+h) + 5 - (4x^2 - 7x + 5)}{h} =$$

$$\frac{\cancel{4x^2} + 8xh + 4h^2 - \cancel{7x} - 7h + \cancel{5} - \cancel{4x^2} + \cancel{7x} - \cancel{5}}{h} =$$

$$\frac{8xh + 4h^2 - 7h}{h} = \frac{\cancel{h}(8x + 4h - 7)}{\cancel{h}} =$$

$$8x + 4h - 7$$