

For questions 2 and 3, show your work in the space provided.

2. Solve the inequality $\frac{1}{x-1} \geq \frac{1-x}{2}$. [25]

Solution: First bring everything to one side:

$$\frac{1}{x-1} - \frac{1-x}{2} \geq 0.$$

Simplify:

$$\frac{2 - (x-1)(1-x)}{(x-1) \cdot 2} \geq 0; \quad \frac{x^2 - 2x + 3}{(x-1) \cdot 2} \geq 0.$$

The discriminant of the numerator is $D = 4 - 12 = -8 < 0$. Since the discriminant is negative, the numerator has no roots. So, the numerator is always positive and therefore the sign is the same as the sign of the denominator. Testing the sign of the denominator:

$$\frac{-}{-} \quad \frac{+}{+}$$

The point $x=1$ does not belong to the solution set, since it is not in the domain.

Answer: $x \in (1, \infty)$.

3. Find an equation of the line parallel to the y -axis passing through the vertex of the parabola $2y + 3x^2 - 6x - 2 = 0$. [25]

Solution: Complete the square:

$$2y + 3(x^2 - 2x) - 2 = 0, \quad 2y + 3(x^2 - 2x + 1) - 3 - 2 = 0, \quad 2y + 3(x-1)^2 - 3 - 2 = 0.$$

Simplify:

$$2y + 3(x-1)^2 - 5 = 0; \quad y = -\frac{3}{2}(x-1)^2 + \frac{5}{2}.$$

So, the point $(1, \frac{5}{2})$ is the vertex of the parabola.

Parallel to the y -axis means a vertical line, so $x = 1$.

Answer: $x = 1$.

END OF PAPER