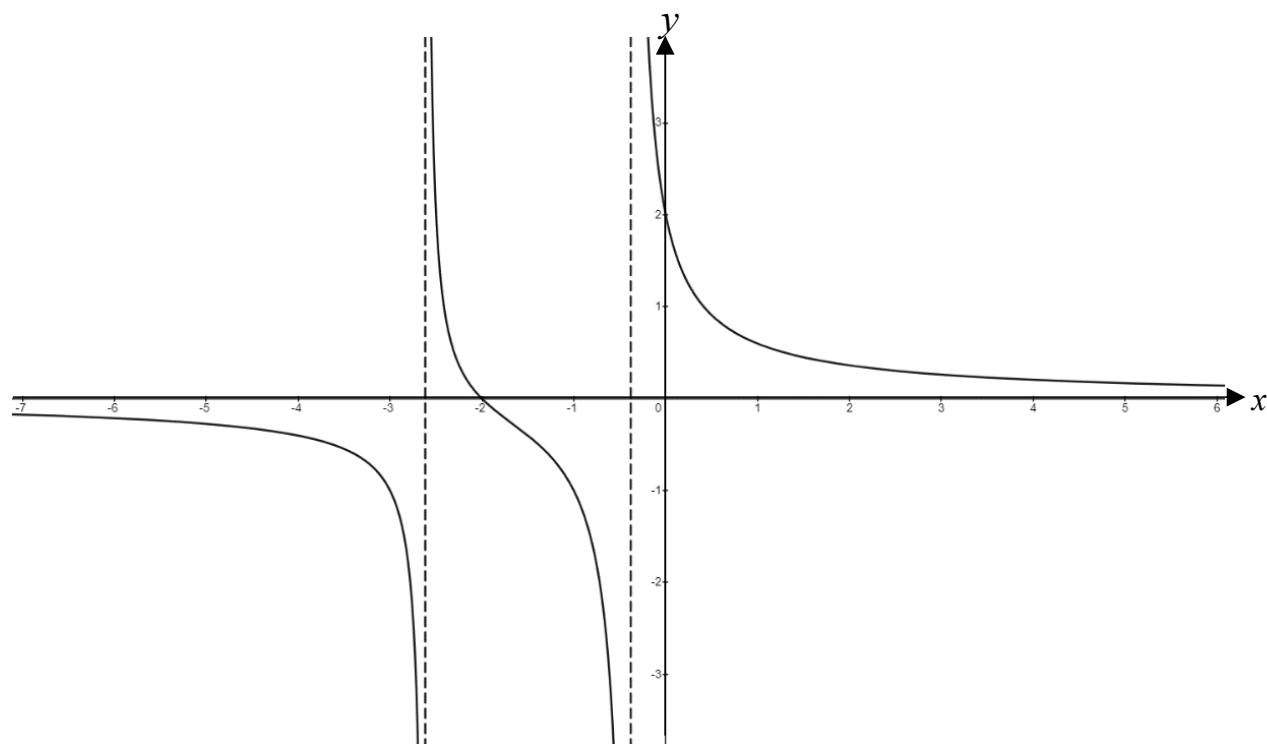
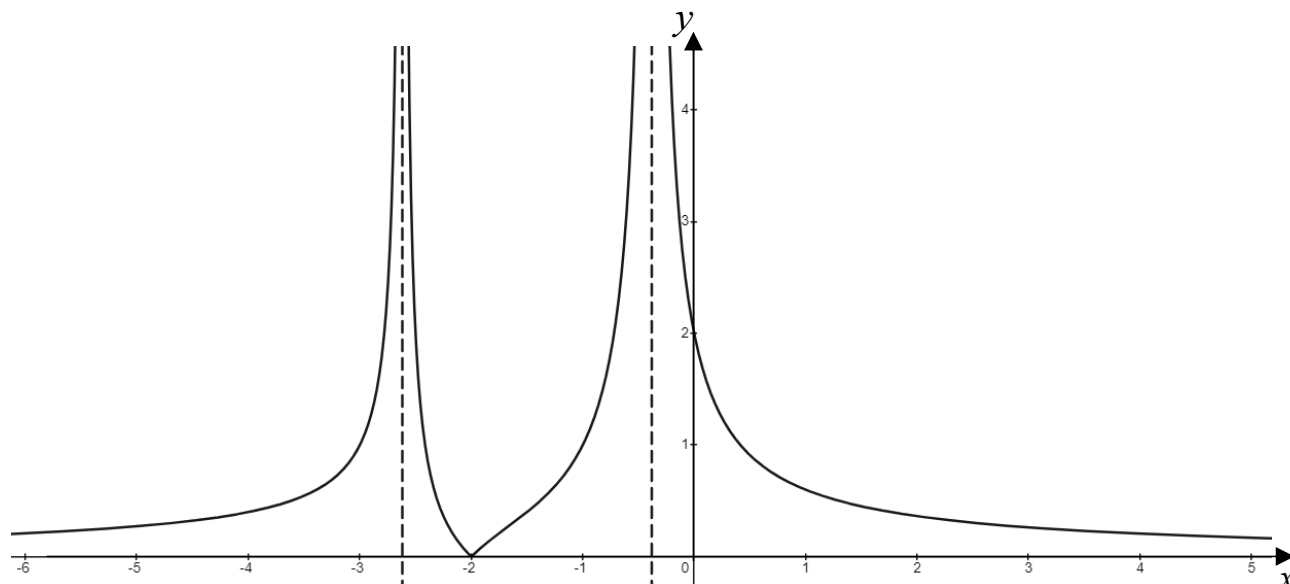


|      |                                                                                        |
|------|----------------------------------------------------------------------------------------|
| 7(a) | $x = -\frac{3}{2} - \frac{1}{2}\sqrt{5}, \quad x = -\frac{3}{2} + \frac{1}{2}\sqrt{5}$ |
|      | $y = 0$                                                                                |
|      |                                                                                        |
| 7(b) | $\frac{dy}{dx} = \frac{(x^2 + 3x + 1)(1) - (x + 2)(2x + 3)}{(x^2 + 3x + 1)^2}$         |
|      | $x^2 + 4x + 5 = 0$                                                                     |
|      | Discriminant is $4^2 - 20 = -4 < 0$ so no real roots.                                  |
|      |                                                                                        |

7(c)



7(d)



7(e)

$$\frac{x+2}{x^2+3x+1} = 2 \text{ or } \frac{x+2}{x^2+3x+1} = -2$$

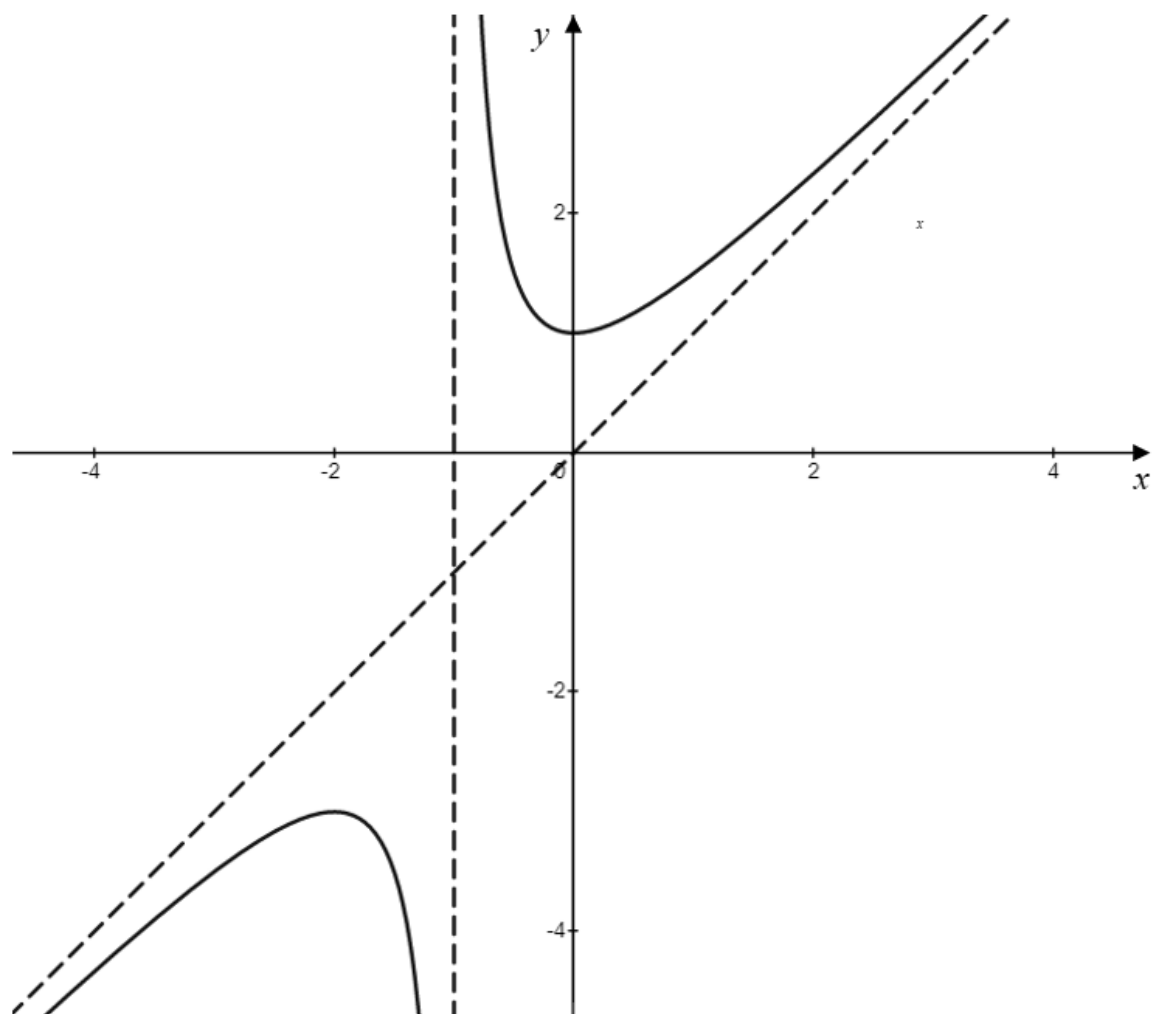
$$-2x^2 - 5x = 0 \text{ or } 2x^2 + 7x + 4 = 0$$

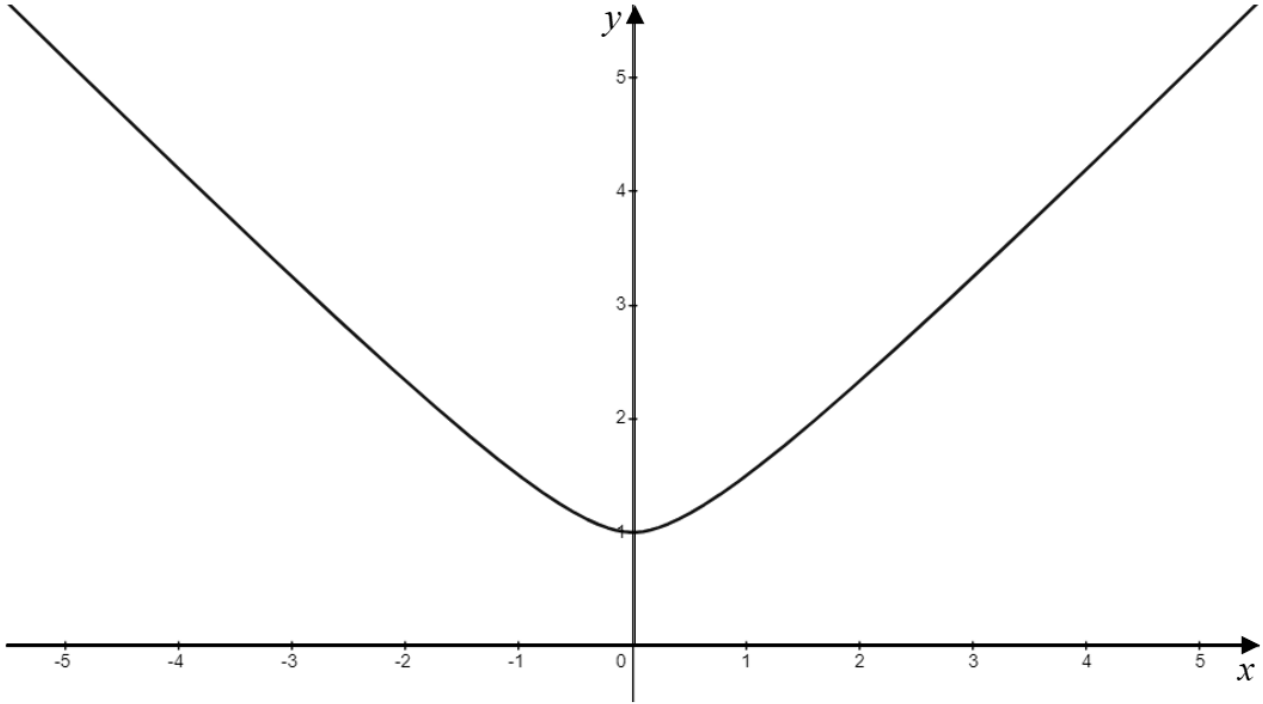
$$x = -\frac{5}{2}, \quad x = 0 \text{ or } x = -\frac{7}{4} - \frac{1}{4}\sqrt{17}, \quad x = -\frac{7}{4} + \frac{1}{4}\sqrt{17}$$

$$-\frac{7}{4} - \frac{1}{4}\sqrt{17} < x < -\frac{5}{2}, \quad -\frac{7}{4} + \frac{1}{4}\sqrt{17} < x < 0, \quad x \neq -\frac{3}{2} \pm \frac{1}{2}\sqrt{5}$$

|      |                                                |
|------|------------------------------------------------|
| 7(a) | $x = -1$                                       |
|      | $y = \frac{x(x+1)+1}{x+1}$                     |
|      | $y = x$                                        |
|      |                                                |
| 7(b) | $\frac{dy}{dx} = \frac{x^2 + 2x}{(x+1)^2} = 0$ |
|      | $(0,1), (-2,-3)$                               |
|      |                                                |

7(c)



|      |                                                                                    |
|------|------------------------------------------------------------------------------------|
| 7(d) |  |
| 7(e) | $\frac{x^2 + x + 1}{x + 1} = 3$ $x^2 - 2x - 2 = 0$                                 |
|      | $x = 1 + \sqrt{3}$                                                                 |
|      | $-1 - \sqrt{3} < x < 1 + \sqrt{3}$                                                 |
|      |                                                                                    |

|      |                                                                                                                                  |
|------|----------------------------------------------------------------------------------------------------------------------------------|
| 7(a) | $x = 1.8$                                                                                                                        |
|      | $y = \frac{(10x - 18)\left(x + \frac{7}{10}\right) - \frac{27}{5}}{10x - 18} = x + \frac{7}{10} - \frac{\frac{27}{5}}{10x - 18}$ |
|      | $y = x + 0.7$                                                                                                                    |
|      |                                                                                                                                  |

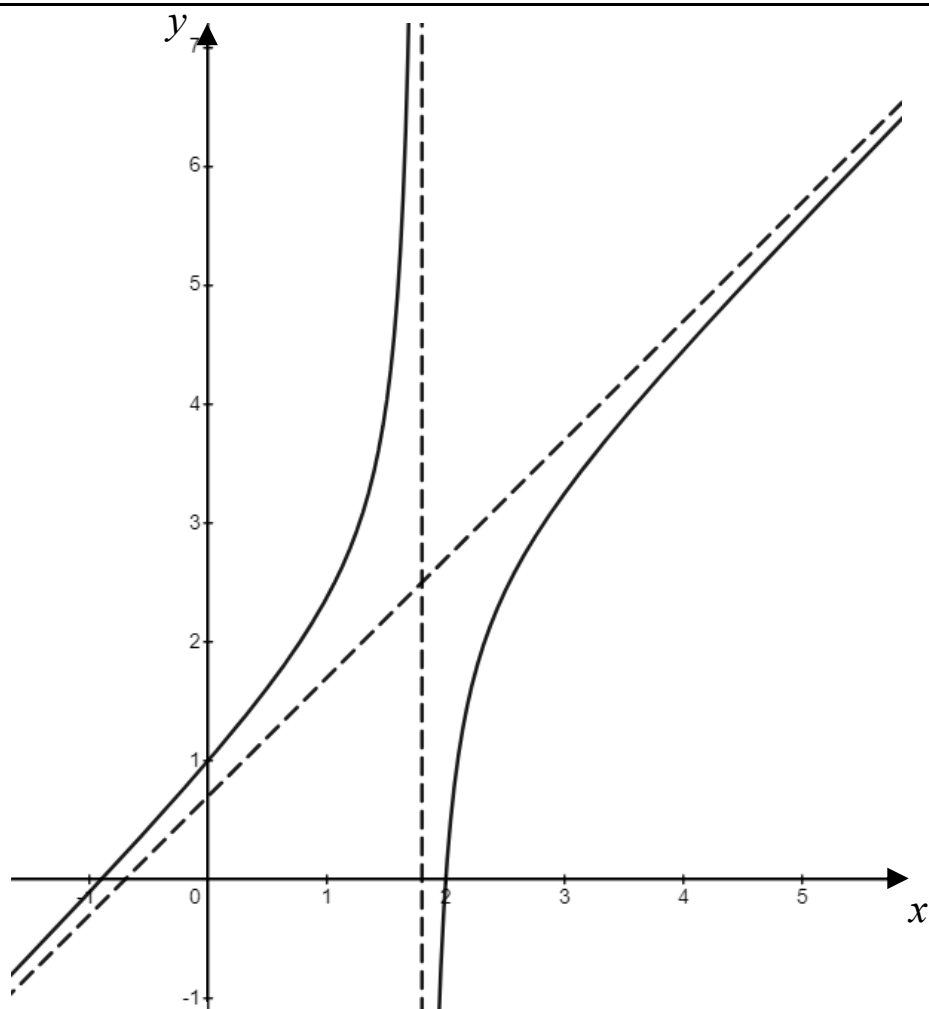
7(b)

$$\frac{dy}{dx} = \frac{100x^2 - 360x + 378}{(10x - 18)^2}$$

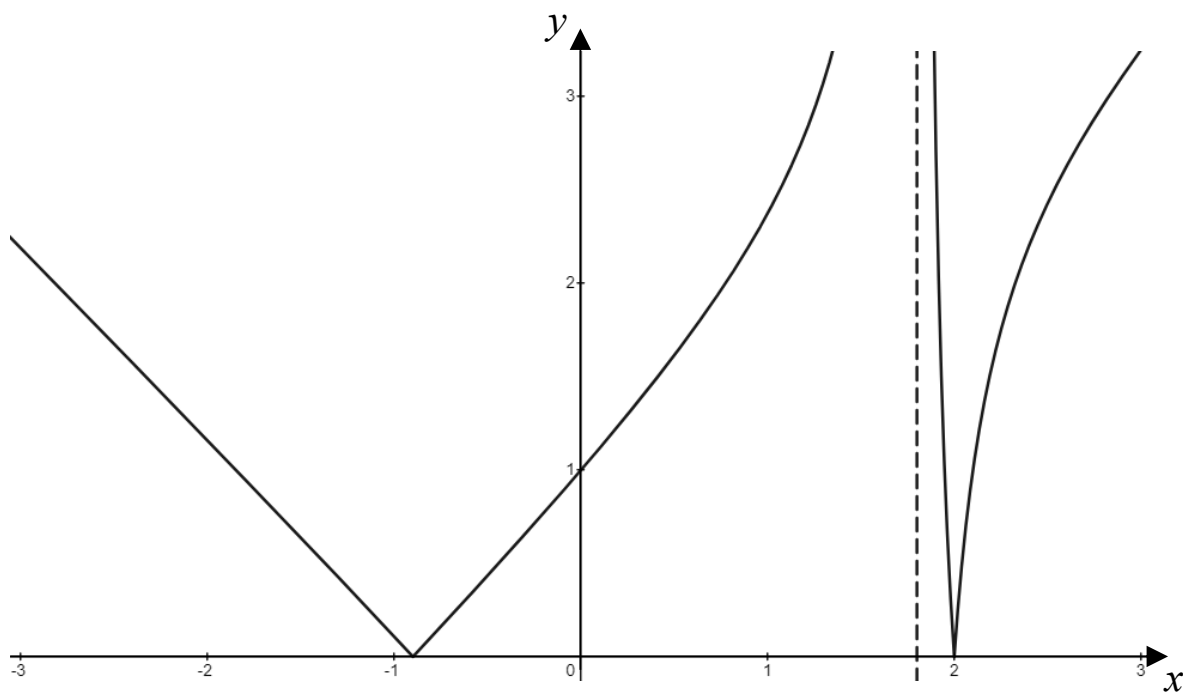
$$50x^2 - 180x + 189 = 0 \quad \left( \text{or } \frac{dy}{dx} = 1 + \frac{54}{(10x - 18)^2} \right)$$

$$180^2 - 4(50)(189) = -5400 < 0 \quad (\text{or } y' > 0) \Rightarrow \text{No stationary points}$$

7(c)

 $(0,1), (-0.9,0), (2,0)$

7(d)



7(e)

$$\left[ \frac{10x^2 - 11x - 18}{10x - 18} = -4 \Rightarrow x = \frac{-29 \pm \sqrt{4441}}{20} \right]$$

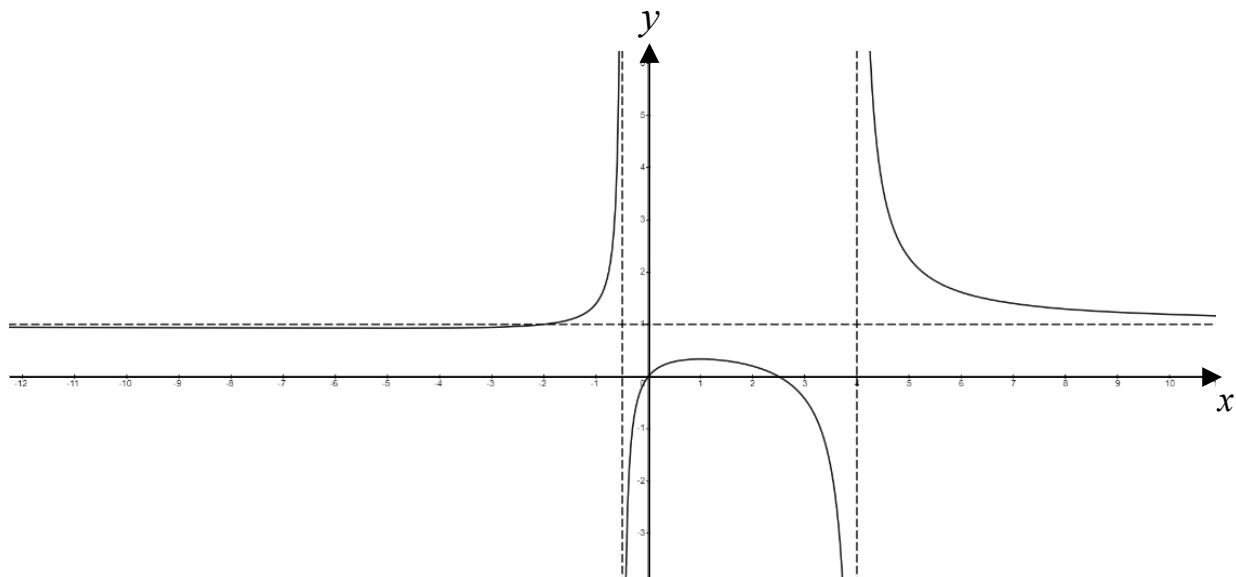
$$\frac{10x^2 - 11x - 18}{10x - 18} = 4$$

$$10x^2 - 51x + 54 = 0$$

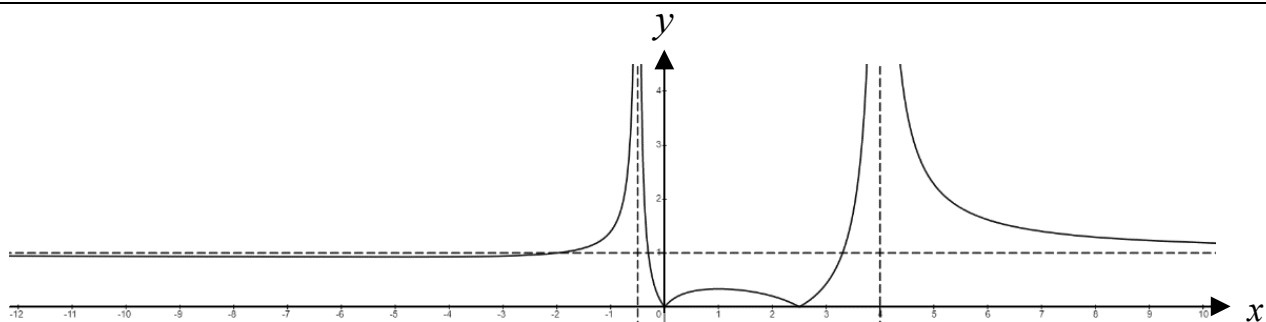
$$p = \frac{3}{2}, \quad q = \frac{18}{5}$$

|      |                                                                                           |
|------|-------------------------------------------------------------------------------------------|
| 7(a) | $x = -\frac{1}{2}, \quad x = 4$                                                           |
|      | $y = 1$                                                                                   |
|      |                                                                                           |
| 7(b) | $\frac{dy}{dx} = \frac{(2x^2 - 7x - 4)(4x - 5) - (2x^2 - 5x)(4x - 7)}{(2x^2 - 7x - 4)^2}$ |
|      | $4x^2 + 16x - 20 = 0$                                                                     |
|      | $\left(-5, \frac{25}{27}\right) \quad \left(1, \frac{1}{3}\right)$                        |
|      |                                                                                           |

7(c)


 $(0,0), \left(\frac{5}{2},0\right)$ 

7(d)



7(e)

$$\frac{2x^2 - 5x}{2x^2 - 7x - 4} = \frac{1}{9} \text{ or } \frac{2x^2 - 5x}{2x^2 - 7x - 4} = -\frac{1}{9}$$

$$16x^2 - 38x + 4 = 0 \text{ or } 20x^2 - 52x - 4 = 0$$

$$x = \frac{19}{16} + \frac{3}{16}\sqrt{33}, \quad x = \frac{19}{16} - \frac{3}{16}\sqrt{33} \text{ or } x = \frac{13}{10} + \frac{3}{10}\sqrt{21}, \quad x = \frac{13}{10} - \frac{3}{10}\sqrt{21}$$

$$\frac{13}{10} - \frac{3}{10}\sqrt{21} < x < \frac{19}{16} - \frac{3}{16}\sqrt{33}, \quad \frac{19}{16} + \frac{3}{16}\sqrt{33} < x < \frac{13}{10} + \frac{3}{10}\sqrt{21}$$

6(a)

$$x = -a$$

$$y = \frac{(x+a)(x-a) + a^2 + a}{x+a} = x - a + \frac{a^2 + a}{x+a}$$

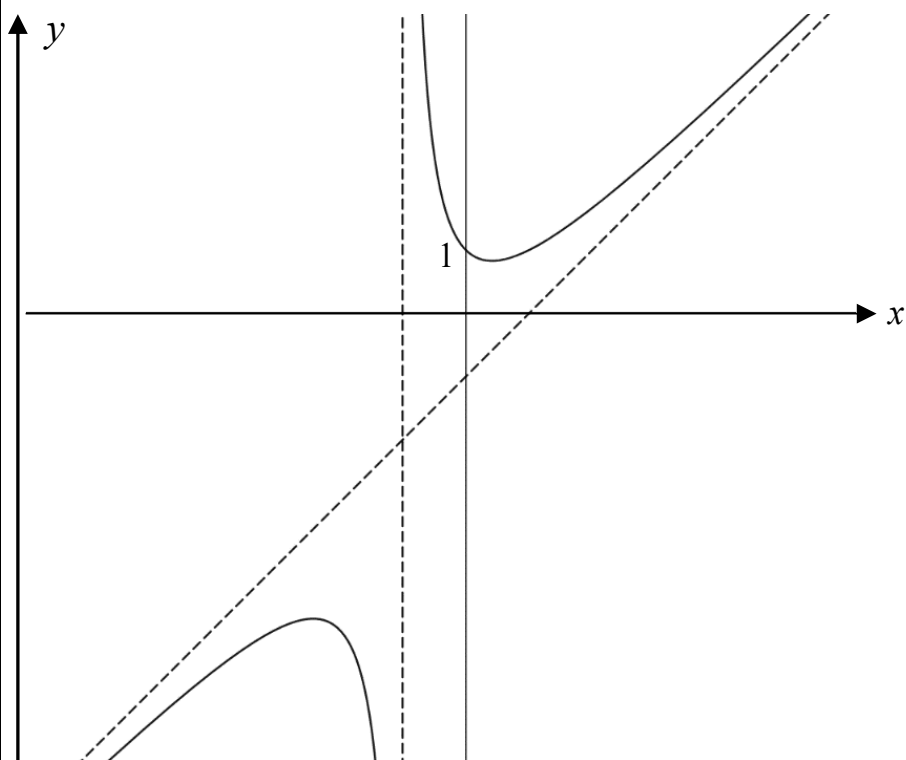
$$y = x - a$$

6(b)

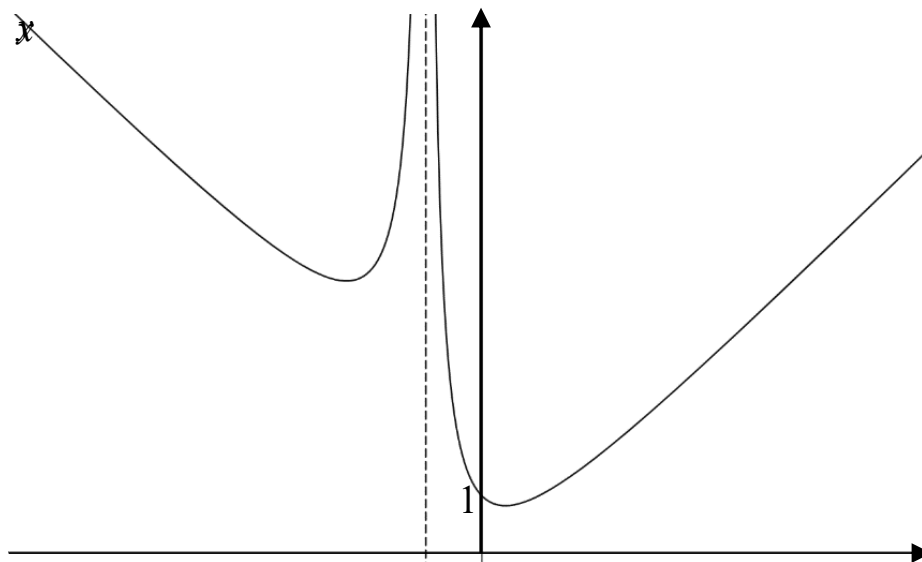
$$\frac{dy}{dx} = 1 - (a^2 + a)(x+a)^{-2} = 0 \text{ or } x^2 + 2ax - a = 0$$

$$x = -a \pm \sqrt{a^2 + a}$$

6(c)



6(d)



6(e)

$$\frac{x^2 + a}{x + a} = a$$

$$x^2 - ax + a - a^2 = 0$$

$$\text{Or } \frac{x^2 + a}{x + a} = -a \Rightarrow x^2 + ax + a + a^2 = 0$$

$$a^2 - 4(a - a^2) = 5a^2 - 4a > 0$$

$$a > \frac{4}{5}.$$