

SOLUTIONS TO APRIL 27 EXERCISES

BY

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EXERCISE 1.1.A. - 1.1.C.

1.A. and 1.B.

$$y = \frac{1}{x}$$

$$x \cdot y = \frac{1}{x} \cdot x$$

$$xy = 1 \neq 0$$

$$\therefore x, y \neq 0$$

{ $y = \frac{1}{x}$ has a vertical asymptote at $y = 0$, and a horizontal asymptote at $x = 0$ }

1.C.

$$y = \frac{1}{x}, \quad y = x$$

$$\therefore \frac{1}{x} = x$$

$$x \cdot \frac{1}{x} = x \cdot x$$

$$1 = x^2$$

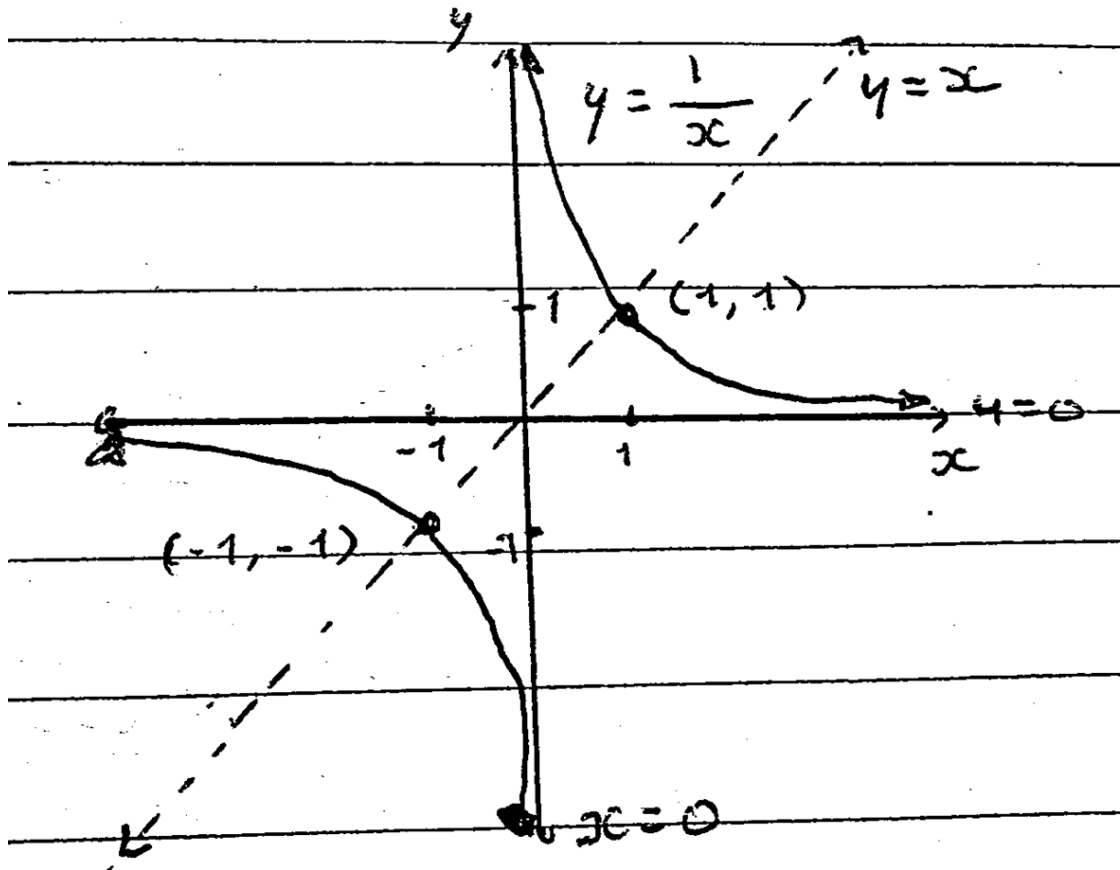
$$\pm \sqrt{1} = x$$

$$\pm 1 = x$$

But $y = x$,

$\therefore y = \frac{1}{x}$ and $y = x$ intersect at $(1, 1)$ and $(-1, -1)$

EXERCISE 1.1 SKETCH



EXERCISE 2.I.A. - 2.I.C.

1.A. and 1.B.

$$y = \frac{3}{x}$$

$$x \cdot y = \frac{3}{x} \cdot x$$

$$xy = 3 \neq 0$$

$$\therefore x, y \neq 0$$

1.C.

$$y = \frac{3}{x}, \quad y = x$$

$$\frac{3}{x} = x$$

$$x \cdot \frac{3}{x} = x \cdot x$$

$$3 = x^2$$

$$\pm\sqrt{3} = x$$

But $y = x$,

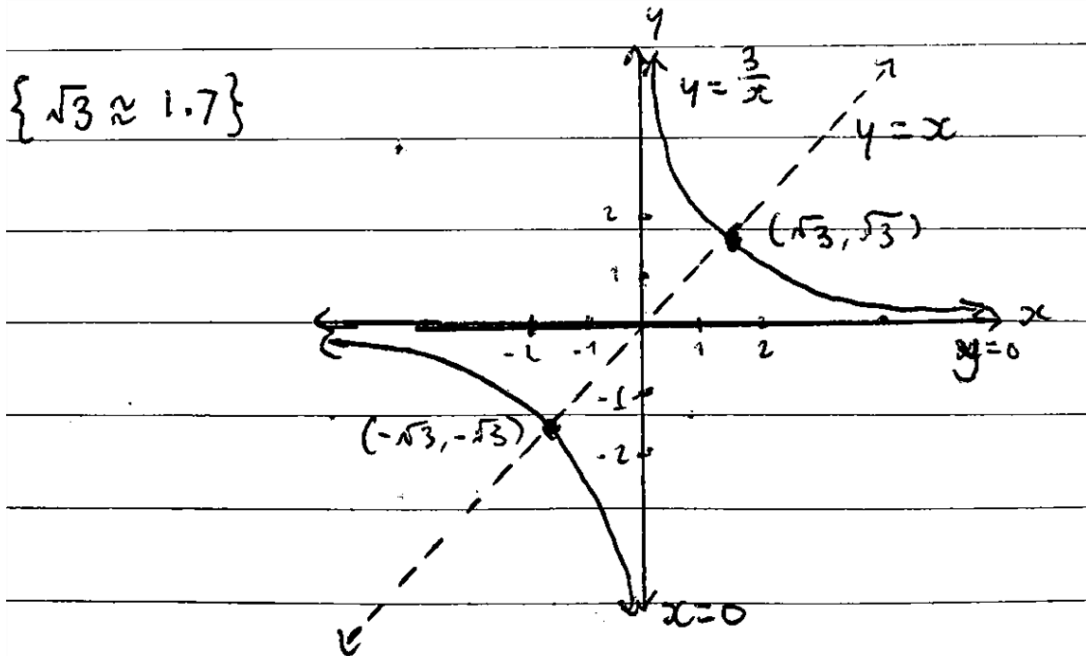
$\therefore y = \frac{3}{x}$ and $y = x$ intersect at

$(\sqrt{3}, \sqrt{3})$ and $(-\sqrt{3}, -\sqrt{3})$.

EXERCISE 2.I.D & 2.I SKETCH

1.D.

Dilation of $y = \frac{1}{x}$ by a factor of 3 from the x axis,
i.e. $y = 3 \cdot \frac{1}{x}$, e.g. the point $(1, 1)$ on $y = \frac{1}{x}$
becomes $(1, 3)$ on $y = \frac{3}{x}$.



EXERCISE 2.2.A. - 2.2.C.

2.A. and 2.B.

$$y = 2 - \frac{7}{x}$$

$$y - 2 = 2 - 2 - \frac{7}{x}$$

$$y - 2 = -\frac{7}{x}$$

$$x \cdot (y - 2) = -\frac{7}{x} \cdot x$$

$$x(y - 2) = -7 \neq 0$$

$$\therefore x \neq 0$$

$$\therefore y - 2 \neq 0$$

$$y - 2 + 2 \neq 0 + 2$$

$$y \neq 2$$

2.C.

$y = 2 - \frac{7}{x}$ has its centre at:

$(0, 2)$

$\{ (x \text{ asymptote}, y \text{ asymptote}) \}$

EXERCISE 2.2.D.

2.D.

$$y = 2 - \frac{7}{x}, \quad y = -x + 2 \quad \{(1)\}$$

$$2 - \frac{7}{x} = -x + 2$$

$$2 - 2 - \frac{7}{x} = -x + 2 - 2$$

$$-\frac{7}{x} = -x$$

$$-1 \cdot -\frac{7}{x} = -1 \cdot -x$$

$$\frac{7}{x} = x$$

$$x \cdot \frac{7}{x} = x \cdot x$$

$$7 = x^2$$

$$\pm\sqrt{7} = x \quad \{(2)\}$$

(2) into (1),

$$y = -(\pm\sqrt{7}) + 2$$

$$\begin{aligned} \text{When } x = +\sqrt{7}, \quad y &= -(+\sqrt{7}) + 2 \\ &= -\sqrt{7} + 2 \end{aligned}$$

$$\begin{aligned} \text{When } x = -\sqrt{7}, \quad y &= -(-\sqrt{7}) + 2 \\ &= \sqrt{7} + 2 \end{aligned}$$

$\therefore y = 2 - \frac{7}{x}$ and $y = -x + 2$ intersect
at $(\sqrt{7}, -\sqrt{7} + 2)$ and $(-\sqrt{7}, \sqrt{7} + 2)$

EXERCISE 2.2 SKETCH

Oops, we need an x

intercept!

$$y = 2 - \frac{7}{x} = 0$$

$$2 - 2 - \frac{7}{x} = 0 - 2$$

$$-\frac{7}{x} = -2$$

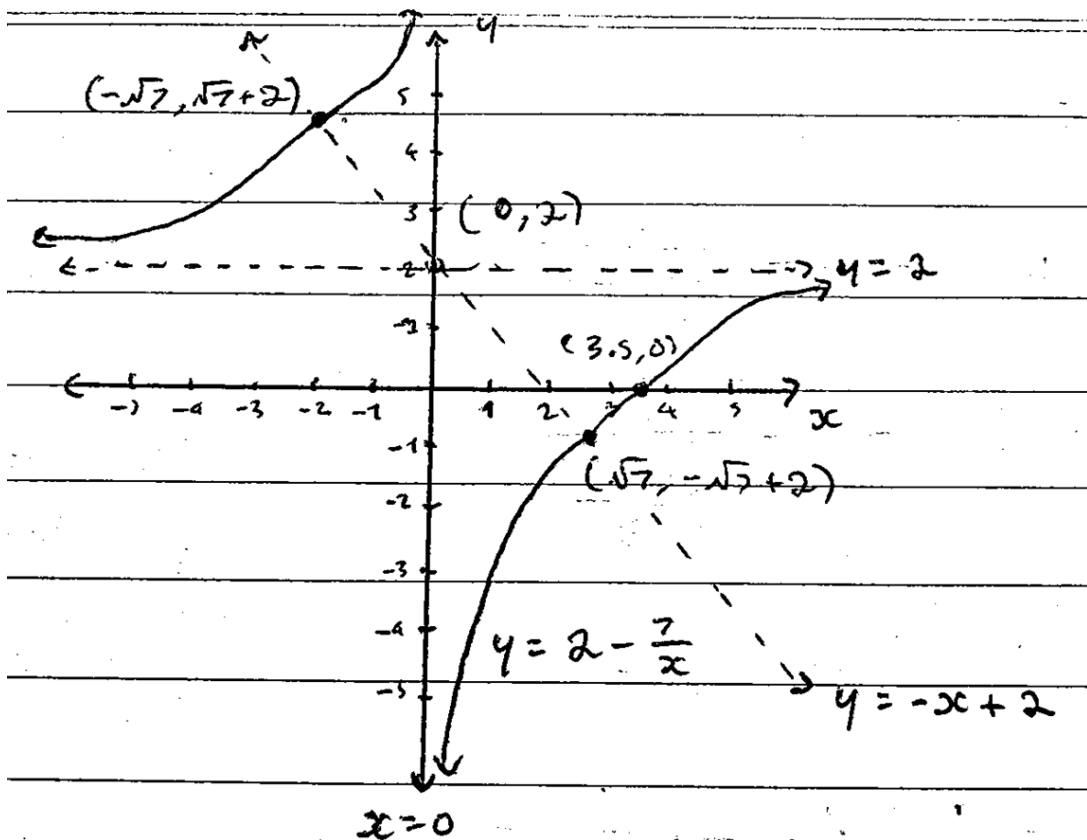
$$x \cdot -\frac{7}{x} = -2 \cdot x$$

$$-7 = -2x$$

$$\frac{-7}{-2} = \frac{-2x}{2}$$

$$x = \frac{7}{2} = 3.5$$

$$\left. \begin{aligned} \sqrt{7} &\approx 2.6, \\ -\sqrt{7} &\approx -2.6, \\ \sqrt{7} + 2 &\approx 4.6, \\ -\sqrt{7} + 2 &\approx -0.6 \end{aligned} \right\}$$



EXERCISE 3.I.A. - 3.I.C.

1.A., 1.B. and 1.C,

$$y = -4 - \frac{2}{3x-3}$$

$$y+4 = -4+4 - \frac{2}{3x-3}$$

$$y+4 = -\frac{2}{3x-3}$$

$$(3x-3)(y+4) = -\frac{2}{(3x-3)} \cdot (3x-3)$$

$$(3x-3)(y+4) = -2 \neq 0$$

$$\therefore 3x-3 \neq 0$$

$$3x \neq 3$$

$$x \neq 1$$

$$\therefore y+4 \neq 0$$

$$y+4-4 \neq 0-4$$

$$y \neq -4$$

$$y = -4 - \frac{2}{3x-3} \text{ has its}$$

centre at $(1, -4)$

EXERCISE 3.I.D.

1.D.

$$y = -4 - \frac{2}{3x-3}$$

$$= -4 - \frac{\frac{2}{3}}{\frac{3x-3}{3}}$$

{ divide top and bottom of fraction by 3 }

$$= -4 - \frac{\frac{2}{3}}{x-1}$$

$$y = \boxed{-4} - \frac{\frac{2}{3}}{\boxed{x-1}}$$

{ now, we can very clearly see the transformations of $y = \frac{1}{x}$ }

Translate
 $y = \frac{1}{x}$ 4 units
down

shift/translate $y = \frac{1}{x}$
1 unit to the right

flip $y = \frac{1}{x}$ and
dilate by a factor
of $\frac{2}{3}$ from the
x axis

EXERCISE 3.I.E.

1.E.

$$y = -4 - \frac{2}{3x-3}, \quad y = -(x-1) - 4 \quad \{(1)\}$$

$$-4 - \frac{2}{3x-3} = -(x-1) - 4$$

$$= -x - 3$$

$$-4(3x-3) - 2 = (-x-3)(3x-3)$$

$$-12x + 12 - 2 = -3x^2 + 3x - 9x + 9$$

$$-12x + 10 = -3x^2 - 6x + 9$$

$$1 = -3x^2 + 6x$$

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

$$0 = x^2 - 2x + \frac{1}{3}$$

$$\therefore x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(\frac{1}{3})}}{2(1)} \quad \left\{ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \right\}$$

$$= \frac{2 \pm \sqrt{4 - \frac{4}{3}}}{2}$$

$$= \frac{2 \pm \sqrt{\frac{8}{3}}}{2}$$

$$= \frac{2}{2} \pm \frac{\sqrt{\frac{8}{3}}}{2}$$

$$x = 1 \pm \frac{\sqrt{8/3}}{2} \quad \{(2)\}$$

Continued on Pages 13 & 14

EXERCISE 3.I.E.

(2) into (1)

$$\begin{aligned} y &= -(x-1) - 4 \\ &= -x - 3 \\ &= -\left(1 + \frac{\sqrt{8/3}}{2}\right) - 3 \end{aligned}$$

$$\begin{aligned} \text{When } x &= 1 + \frac{\sqrt{8/3}}{2}, \quad y = -\left(1 + \frac{\sqrt{8/3}}{2}\right) - 3 \\ &= -1 - \frac{\sqrt{8/3}}{2} - 3 \\ &= -4 - \frac{\sqrt{8/3}}{2} \end{aligned}$$

$$y = \frac{-8 - \sqrt{8/3}}{2}$$

$$\text{When } x = 1 - \frac{\sqrt{8/3}}{2},$$

$$y = -\left(1 - \frac{\sqrt{8/3}}{2}\right) - 3$$

$$= -1 + \frac{\sqrt{8/3}}{2} - 3$$

$$= -4 + \frac{\sqrt{8/3}}{2}$$

$$y = \frac{\sqrt{8/3} - 8}{2}$$

EXERCISE 3.I.E.

$$\therefore y = -4 - \frac{2}{3x-3} \quad \text{and} \quad y = -(x-1) - 4$$

intersect at $\left(1 + \frac{\sqrt{8/3}}{2}, \frac{-9 - \sqrt{8/3}}{2}\right)$ and $\left(1 - \frac{\sqrt{8/3}}{2}, \frac{\sqrt{8/3} - 9}{2}\right)$.

EXERCISE 3.I. SKETCH

Again, we need an x intercept, but also a y intercept
this time!

$$y = -4 - \frac{2}{3x-3}$$

Let $y=0 = -4 - \frac{2}{3x-3}$

$$-4 = \frac{2}{3x-3}$$

$$-4(3x-3) = 2$$

$$-12x+12 = 2$$

$$0 = 12x - 10 \quad \{\text{oops}\}$$

$$10 = 12x$$

$$x = \frac{10}{12} \approx 0.83$$

Let $x=0$,

$$y = -4 - \frac{2}{-3}$$

$$= -\frac{10}{3} \approx -3.33$$

