

$$A(3) \doteq 17 \text{ small squares}$$

$$\therefore 16 \text{ small squares} = 1 \text{ unit}$$

$$\therefore 17 \text{ small squares} = \frac{17}{16} \text{ units}$$

$$\doteq 1.1$$

(a)

$$A(3) + A(4) = 1.10 + 1.39$$

$$= 2.49$$

$$\doteq A(12)$$

(b) $A(2) + A(4) = 0.69 + 1.39$

$$= 2.08$$

$$= A(8)$$

(c) $A(10) - A(2) = 2.30 - 0.69$

$$= 1.61$$

$$= A(5)$$

(d)

$$A(9) = 2.20$$

$$= 2 \times 1.10$$

$$= 2 \times A(3)$$

(i) $A(18) = A(3) + A(6)$

$$= 1.10 + 1.79$$

$$= 2.89$$

or $A(18) = A(2) + A(9)$

$$= 0.69 + 2.20$$

$$= 2.89$$

(ii)

$$A(25) = 2 \times A(5)$$

$$= 2 \times 1.61$$

$$= 3.22$$

(iii) $A(2.5) = A(5) - A(2)$

$$= 1.61 - 0.69$$

$$= 0.92$$

(iv) $A(4.5) = A(9) - A(2)$

$$= 2.20 - 0.69$$

$$= 1.51$$

19. The graph is a rectangular hyperbola and has a vertical asymptote with equation $x = -4$ and a horizontal asymptote with equation $y = -1$. These asymptotes intersect at the point $(-4, -1)$. Points $(-3, 0)$ and $(-5, -2)$ are on opposite branches of the curve. Point $(-3, 0)$ is one unit right and one unit up from $(-4, -1)$, while point $(-5, -2)$ is one unit left and one unit down from $(-4, -1)$. This indicates that this hyperbola is congruent to the graph of $y = \frac{1}{x}$ since that graph has

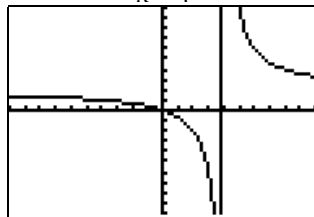
asymptotes which intersect at $(0, 0)$ and the curve passes through $(1, 1)$, which is one unit right and one unit up from $(0, 0)$, and through $(-1, -1)$, which is one unit left and one unit down from $(0, 0)$.

The graph is a translation of the graph of $y = \frac{1}{x}$, four units left and one unit down.

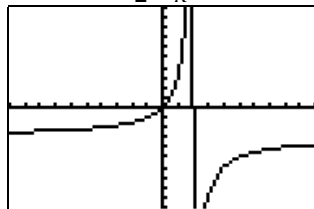
The equation is $f(x) = \frac{1}{x+4} - 1$.

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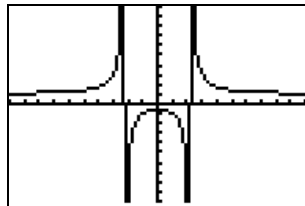
(a) $f(x) = \frac{2x}{x-4}$



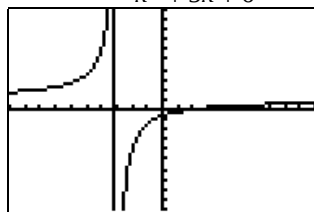
(b) $g(x) = \frac{3x}{2-x}$



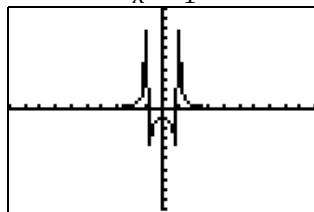
(c) $h(x) = \frac{x^2+3}{x^2-5}$



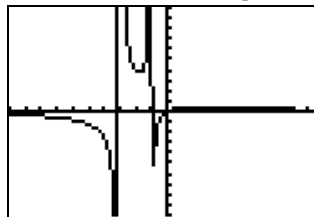
(d) $h(x) = \frac{x^2-4}{x^2+5x+6}$



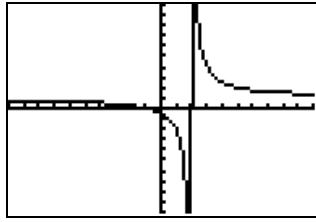
(e) $g(x) = \frac{1}{x^2-1}$



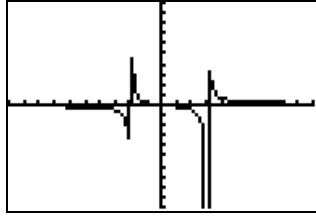
(f) $f(x) = \frac{2x}{x^2+4x+3}$



(g) $b(x) = \frac{x+1}{x-2}$



(h) $m(x) = \frac{x}{x^2 - x - 6}$



Practise, Apply, Solve 4.8, page 353

1. In each case, look for values of the variables that would make the denominator zero. Then restrict the values of the variables to exclude these.

(a) $x - 1 = 0$ when $x = 1$

$\therefore$ restriction is $x \neq 1$.

(b) $2y - 1 = 0$ when $y = \frac{1}{2}$

$\therefore$ restriction is $y \neq \frac{1}{2}$.

(c) $6m^2n = 0$ when $m = 0$ or $n = 0$

$\therefore$ restrictions are $m \neq 0, n \neq 0$.

(d) $2x(x - 3) = 0$ when $x = 0$ or $x = 3$

$\therefore$ restrictions are $x \neq 0, x \neq 3$.

(e) $(p - 4)(p + 2) = 0$ when $p = 4$ or $p = -2$

$\therefore$ restrictions are $p \neq -2, p \neq 4$.

(f) $2(a + b) = 0$ when $a = -b$

$\therefore$ restriction is $a \neq -b$.

(g) $8m(m + 3) = 0$ when $m = 0$ or $m = -3$

$\therefore$ restrictions are $m \neq 0, m \neq -3$.

(h) $5(2x - 3) = 0$ when $x = 1.5$

$\therefore$ restriction is $x \neq 1.5$.

(i) $4a(3a + 4) = 0$ when $a = 0$ or $a = -\frac{4}{3}$

$\therefore$ restrictions are $a \neq 0, a \neq -\frac{4}{3}$.

2. (a) $4(x + 3)$

(b) $5(x + 3)$

(c)

$$\frac{4x+12}{5x+15} = \frac{4(x+3)}{5(x+3)}$$

$$= \frac{4}{5}, x \neq -3$$

3. (a)

$$\begin{aligned} -\frac{a+b}{a-b} &= \frac{a+b}{-(a-b)} \\ &= \frac{a+b}{-a+b} \\ &= \frac{a+b}{b-a} \end{aligned}$$

$\therefore$ equivalent.

(b)

$$\begin{aligned} -\frac{a+b}{b-a} &= \frac{a+b}{-(b-a)} \\ &= \frac{a+b}{-b+a} \\ &= \frac{a+b}{a-b} \end{aligned}$$

$\therefore$ not equivalent.

(c) $-\frac{a+b}{-(b-a)} = \frac{a+b}{b-a}$

$\therefore$ equivalent.

(d)

$$\begin{aligned} -\frac{b+a}{a-b} &= \frac{b+a}{-(a-b)} \\ &= \frac{a+b}{-a+b} \\ &= \frac{a+b}{b-a} \end{aligned}$$

$\therefore$ equivalent.

4. (a) $\frac{x+y}{y+x} = 1$ provided $y \neq -x$

(b) $-\frac{(y-x)}{y-x} = -1$ provided $y \neq x$

(c) $\frac{x-y}{-(y-x)} = \frac{x-y}{x-y} = 1$ provided $y \neq x$

(d) $\frac{-(y+x)}{-(x+y)} = 1$ provided $x \neq -y$

(e) $\frac{-(y-x)}{x-y} = \frac{x-y}{x-y} = 1$ provided $x \neq y$

(f) $\frac{x-y}{y-x} = \frac{x-y}{-(x-y)} = -1$ provided $x \neq y$

5. (a) $\frac{x-2}{(x+5)(x-2)}$

Denominator is zero when $x = -5$ or $x = 2$. Restrictions are $x \neq 2, 5$.

Then $\frac{x-2}{(x+5)(x-2)}$ reduces to $\frac{1}{x+5}$.

(b) $\frac{4y(3y-4)}{(3y-4)(3y+4)}$

Denominator is zero when $y = \pm \frac{4}{3}$. Restriction is $y \neq \pm \frac{4}{3}$.

Then $\frac{4y(3y-4)}{(3y-4)(3y+4)}$ reduces to $\frac{4y}{3y+4}$.