

$$1. \frac{-5x-7}{-7x+1} = \frac{-8}{5}$$

Cross multiply the above term.

$$5(-5x-7) = -8(-7x+1)$$

$$-25x-35 = 56x-8$$

$$-35+8 = 56x+25x$$

$$-27 = 81x$$

$$x = -\frac{27}{81} \Rightarrow -\frac{1}{3}$$

$$2. y = f(x) = \frac{x^2-3x}{x^2-7x+12}$$

a.

$$x^2-7x+12=0..$$

$$x^2-4x-3x+12=0$$

$$x(x-4)-3(x-4)=0$$

$$(x-3)(x-4)=0$$

$x=3, 4$ ← This points are undefined.

Domain is $x < 3$ or $3 < x < 4$ or $x > 4$

$$(-\infty, 3) \cup (3, 4) \cup (4, \infty)$$

$$b. \frac{x^2-3x}{x^2-7x+12} = \frac{x(x-3)}{(x/3)(x-4)} \Rightarrow \frac{x}{x-4}$$

2. c.

$$\frac{x(x-3)}{(x-3)(x-4)} \Rightarrow \frac{x}{x-4}$$

take denominator $(x-4) = 0$

$x=4$ is the vertical Asymptote

d. where $(x-3)$ is a factor in the numerator and denominator.
Setting this factor equal to zero.

$$x-3=0$$

$$x=3.$$

Substitute $x=3$ in the function $f(x)$

$$\therefore y=0$$

Roots at $(3,0)$

e. Horizontal asymptote for $\frac{x^2-3x}{x^2-7x+12}$

Take leading term $\Rightarrow \frac{x^2}{x^2} \boxed{y=1}$

f. x-intercept:

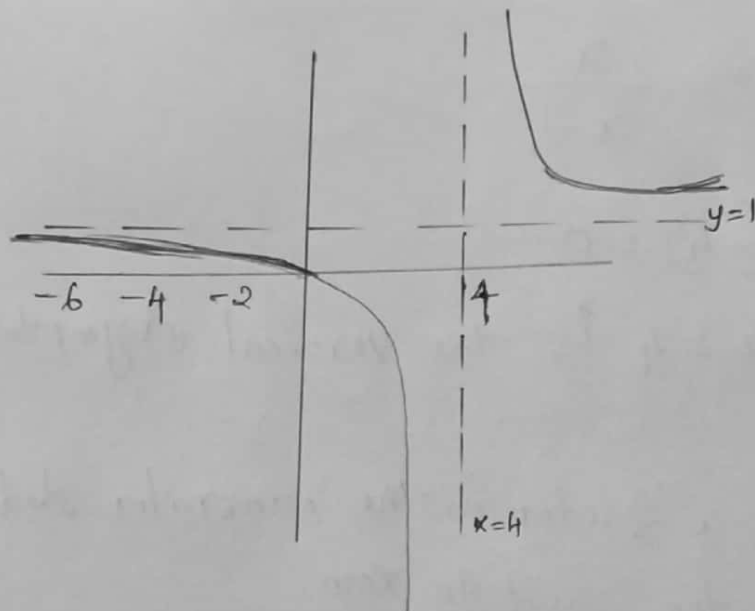
$$y=0$$

$$\frac{x}{x-4} = 0, \quad x=0,$$

x-intercept is $(0,0)$

g. there is no oblique Asymptote.

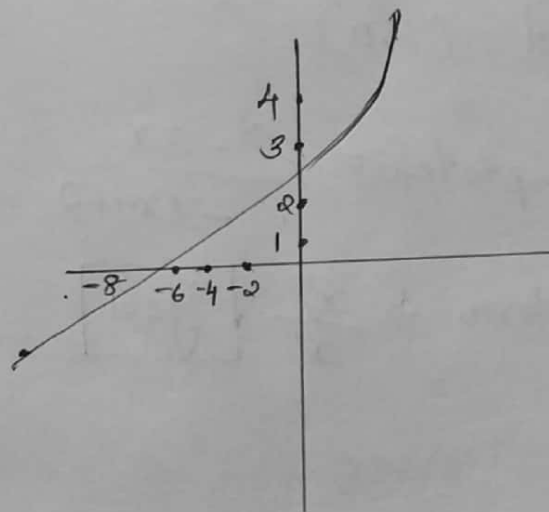
R.



$$i. f(-1) = \frac{-1}{(-1-4)} \Rightarrow \frac{1}{5}$$

$$3. f(x) = \sqrt{-2x+2} + 4$$

a.



b.

$$\sqrt{f(x)} \Rightarrow f(x) \geq 0$$

$$-2x+2 \geq 0$$

$$-2x \geq -2$$

$$x \leq 1$$

Domain is $[-\infty, 1]$

3. c.

the range of an radical function is $-c\sqrt{ax+b} + k$ is
 $f(x) \leq k$

$$\text{Here } k = 4$$

$$f(x) \leq 4 \text{ or } y \leq 4$$

range is $[-\infty, 4]$

d. Initial point is

$$\begin{aligned} \text{e. } f(-4) &= -\sqrt{(-2 \times -4 + 2)} + 4 \\ &= -\sqrt{10} + 4 \Rightarrow -\sqrt{10} + 4 \end{aligned}$$

$$\begin{aligned} \text{f. } f(4) &= -\sqrt{(-2 \times 4 + 2)} + 4 \\ &\Rightarrow -\sqrt{-6} + 4 \\ &= -\sqrt{6}i + 4 \end{aligned}$$

$$4. \quad f(x) = \frac{x^3 - 4x^2 - 3x + 12}{x^2 + 5x + 6}$$

a.) domain is $x^2 + 5x + 6 = 0$,

$$\cancel{x^2 + 6} \quad x^2 + 2x + 3x + 6 = 0,$$

$$x(x+2) + 3(x+2) = 0,$$

$$(x+2)(x+3) = 0,$$

$$x \neq -2, -3$$

$$x < -3 \text{ or } -3 < x < -2 \text{ or } x > -2$$

Domain is $(-\infty, -3) \cup (-3, -2) \cup (-2, \infty)$

$$\begin{aligned}
 \text{Ab. } \frac{x^3 - 4x^2 - 3x + 12}{x^2 + 5x + 3} &= \frac{x^2(x-4) - 3(x-4)}{(x+2)(x+3)} \\
 &= \frac{(x-4)(x^2-3)}{(x+2)(x+3)}
 \end{aligned}$$

c. Vertical Asymptote:

$$x = -2 \text{ and } x = -3$$

d. Here is no holes

e. Horizontal asymptote: ~~is~~

There is no horizontal asymptote.

f. x. intercept $\Rightarrow y = 0$..

$$\frac{(x-4)(x^2-3)}{(x+2)(x+3)} = 0$$

$$(x-4)(x^2-3) = 0$$

$$x = 4 \text{ and } x = \pm\sqrt{3}$$

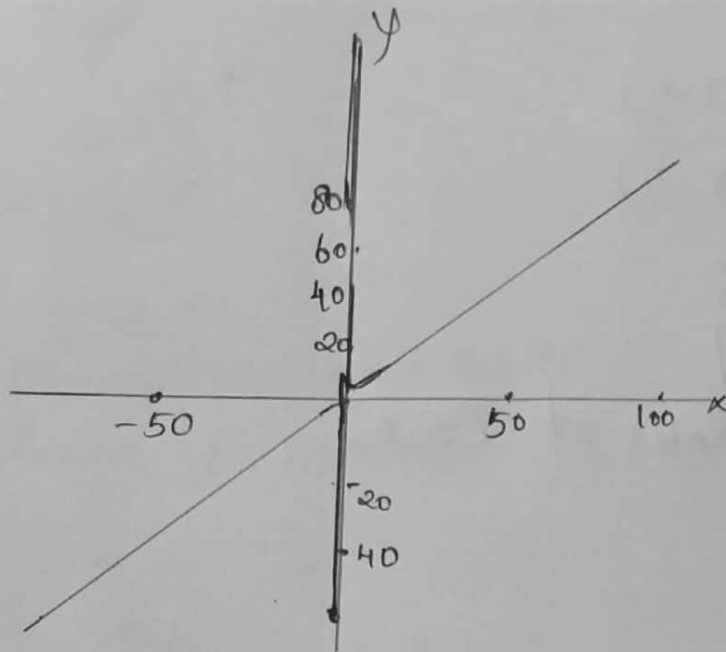
$$(4, 0), (-\sqrt{3}, 0), (\sqrt{3}, 0)$$

g. Oblique asymptote is occur when the degree of the denominator function is one less than the degree of the numerator.

$$\begin{array}{r}
 x-9 \\
 x^2+5x+3 \overline{) x^3-4x^2-3x+12} \\
 \underline{x^3+5x^2+3x} \\
 -9x^2-6x+12 \\
 \underline{-9x^2-45x-27} \\
 39x+39
 \end{array}$$

Oblique asymptote is $y = x - 9$

4. R.



$$4. i \quad f(5) = \frac{5^3 - 4 \times 5^2 - 3 \times 5 + 12}{5^2 + 5 \times 5 + 6} = \frac{11}{28}$$

5).

$$a. \quad f(x) = \frac{x^2 - 9x + 20}{x^3 - 5x^2}$$

$$x^2(x-5) = 0$$

$$x \neq 0, x \neq 5$$

$$x < 0 \text{ or } 0 < x < 5 \text{ or } x > 5$$

$$(-\infty, 0) \cup (0, 5) \cup (5, \infty)$$

b.

$$f(x) = \frac{x^2 - 4x + 5x + 20}{x^2(x-5)} \Rightarrow \frac{(x-4)(x/5)}{x^2(x/5)}$$

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

c.

vertical asymptote is $x = 0$

$$5d) \quad f(x) = \frac{(x-4)(x-5)}{x^2(x-5)}$$

$$x-5=0$$

$$\boxed{x=5}$$

Therefore holes at $(5,0)$

$$e. \quad \frac{x-4}{x^2} = 0$$

Numerator degree is less than denominator degree function.

$$\text{Therefore } y=0$$

$$f. \quad x\text{-intercept: } y=0$$

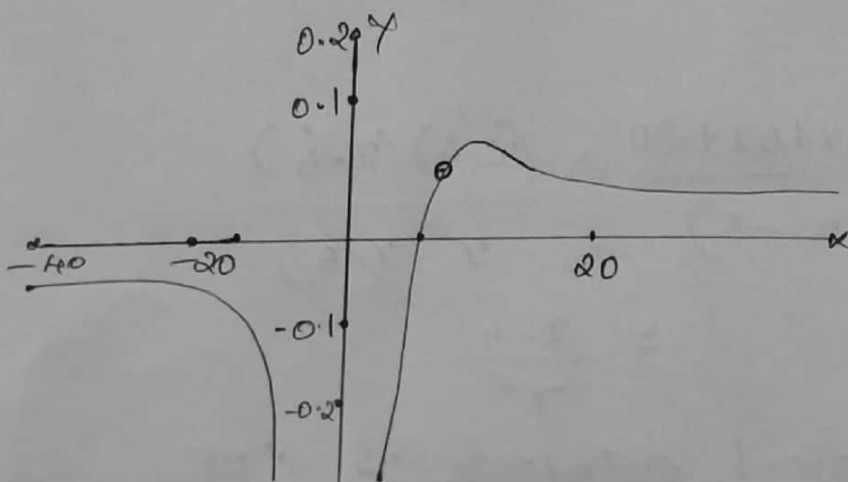
$$\frac{x-4}{x^2} = 0 \Rightarrow x-4=0$$

$$x=4$$

x -intercept is $(4,0)$

g. Here is no oblique asymptote

h.



$$i. \quad f(-8) = \frac{-8-4}{(-8)^2} = \frac{-12}{64} \Rightarrow -\frac{3}{16}$$

6. $y = \frac{x-5}{x^2+4}$

a. $x^2 = -4$

$x = -2i, 2i$

No real undefined points.

domain is $(-\infty, \infty)$

b.

$y = \frac{x-5}{x^2+4}$

c. Vertical asymptote

There is no vertical asymptote

d. No holes

e. Horizontal asymptote $y=0$

f. x-intercept.

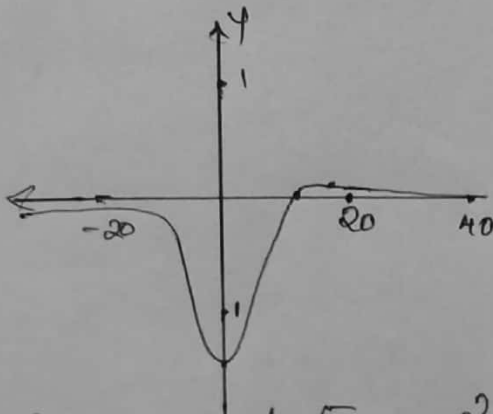
$y=0$

$\frac{x-5}{x^2+4} = 0, \quad x-5=0$
 $x=5$

x-intercept is $(5,0)$

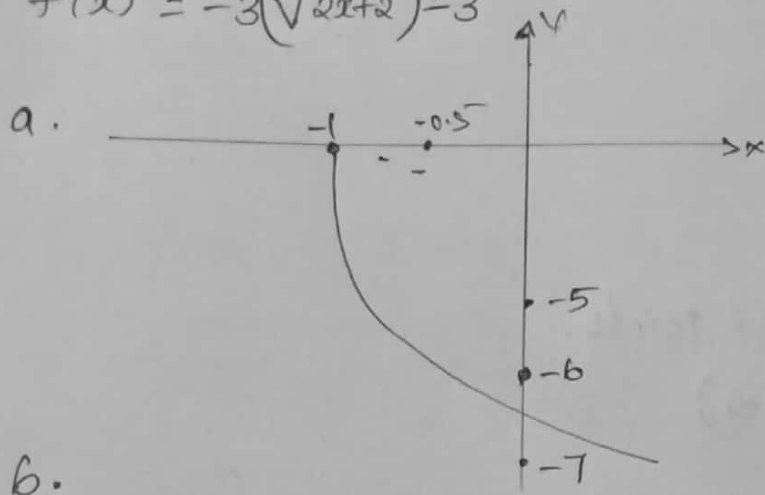
g. No oblique asymptote.

h.



i. $f(1) = \frac{1-5}{1^2+4} = \frac{-4}{5} = -\frac{4}{5}$

$$7. f(x) = -3(\sqrt[3]{2x+2}) - 3$$



$$2x+2 \geq 0$$

$$2x \geq -2$$

$$x \geq -1$$

Domain is $[-1, \infty)$

c. Range is

$$y \leq -3$$

$$(-\infty, -3]$$

$$d. f(0) = -3\sqrt[3]{2(0)+2} - 3 = -3\sqrt[3]{2} - 3$$

$$e. f(3) = -3\sqrt[3]{2(3)+2} - 3 = -9$$

$$8. \sqrt[3]{(x+9)} - 4 = 8$$

$$\sqrt[3]{x+9} = 12$$

$$(x+9) = 12^3$$

$$x+9 = 1728$$

$$\boxed{x = 1719}$$

$$9. -4\sqrt{-9x} + 9 = -4$$

$$-4\sqrt{-9x} = -13$$

$$\sqrt{-9x} = \frac{-13}{-4} \Rightarrow \frac{13}{4}$$

square both sides

$$-9x = \left(\frac{13}{4}\right)^2 = \frac{169}{16}$$

$$x = -\frac{169}{144}$$

$$10. \frac{x-5}{x-8} > 0$$

~~multiply both sides with (x-8)~~

$$x-5 > 0 \text{ (or) } x-8 < 0$$

$$x < 5 \quad x > 8$$

$$(-\infty, 5) \cup (8, \infty)$$

$$11. T = \frac{320}{x^2 + 3x + 10}$$

$$T = 5^\circ\text{C}$$

$$\frac{320}{x^2 + 3x + 10} = 5$$

$$x^2 + 3x + 10 = \frac{320}{5} \Rightarrow 64$$

$$x^2 + 3x + 10 - 64 = 0$$

$$x^2 + 3x - 54 = 0$$

$$(x+9)(x-6) = 0$$

$$x = -9 \text{ (rejected)}$$

$$x = 6 \text{ hours}$$

12. a) $C(x) = 20x + 109.85$

b) $\text{Avg } \overline{C(x)} = \frac{20x + 109.85}{x}$

c) $\overline{C(30)} = \frac{20 \times 30 + 109.85}{30}$

$\overline{C(30)} = \frac{109.85}{30} \Rightarrow 23.66$

d) As x approaches infinity $C'(x)$ will approach its horizontal asymptote.

$\boxed{y = 20}$

13. $g(x) = \frac{2}{(x+3)} + 7$

$f(x) = \frac{1}{x}$

graph $g(x)$ is stretched by 2 units $\Rightarrow 2(\frac{1}{x})$

Horizontal shift by 3 units $\Rightarrow 2(\frac{1}{x+3})$

Vertical shift up by 7 units $\Rightarrow \frac{2}{x+3} + 7$

14. $\sqrt{51-14x} + 4 = x - 2$

$\sqrt{51-14x} = x - 2 - 4 \Rightarrow x - 6$

$51 - 14x = (x - 6)^2$

$x^2 - 12x + 36 = 51 - 14x$

$x^2 + 2x - 15 = 0$;

$x = 3$ false and $x = 5$ false

There is no solution.

$$15. \quad f(x) = \frac{17x^2 - 7x - 12}{7x^3 + 42x}$$

$$\frac{17x^2 - 7x - 12}{7x(x^2 + 6)} = \frac{A}{7x} + \frac{Bx + C}{x^2 + 6}$$

$$= \frac{7Ax(x^2 + 6)}{7x} + \frac{7x(Bx + C)(x^2 + 6)}{x^2 + 6}$$

$$17x^2 - 7x - 12 = A(x^2 + 6) + 7x(Cx + B)$$

$$A = -2,$$

$$7B = -7, \quad -2 + 7C = 17$$

$$B = -1, \quad C = \frac{19}{7}$$

$$\Rightarrow \left[\frac{-2}{7x} + \frac{19x - 7}{7(x^2 + 6)} \right]$$

$$16. \quad \frac{3x^3 + 11x^2 + x + 10}{x^2 + 3x - 4} = 3x + \frac{x^2 + 13x + 10}{x^2 + 3x - 4}$$

$$= 3x + 2 + \frac{7x + 18}{x^2 + 3x - 4}$$

$$\frac{7x + 18}{x^2 + 3x - 4} = \frac{5}{x - 1} + \frac{2}{x + 4}$$

$$\Rightarrow \left[3x + 2 + \frac{5}{x - 1} + \frac{2}{x + 4} \right]$$

$$17. \frac{5x+22}{x^2+8x+16} = \frac{5x+22}{(x+4)^2}$$

$$\frac{5x+22}{(x+4)^2} = \frac{A}{x+4} + \frac{B}{(x+4)^2}$$

$$5x+22 = A(x+4) + B$$

For the denominator root -4

$$B = 2$$

$$5x+22 = A(x+4) + 2$$

$$A = 5$$

$$\boxed{\frac{5x+22}{(x+4)^2} = \frac{5}{x+4} + \frac{2}{(x+4)^2}}$$