(9) Possible Rational Zeros = $\dfrac{\text{Factors of constant term}}{\text{Factors of leading coeff.}}$

Constant term = 6. → Factors: $\pm 1; \pm 2; \pm 3; \pm 6$

Leading coeff. = -4 → Factors: $\pm 1; \pm 2; \pm 4$

Possible rational zeros = $\dfrac{\pm 1; \pm 2; \pm 3; \pm 6}{\pm 1; \pm 2; \pm 4}$

$$= \boxed{\left\{ \pm 1; \pm \frac{1}{2}; \pm \frac{1}{4}; \pm 2; \pm 3; \pm \frac{3}{2}; \pm \frac{3}{4}; \pm 6 \right\}}$$

(C).

(10) To find the domain of a rational function, we first set denominator = 0.

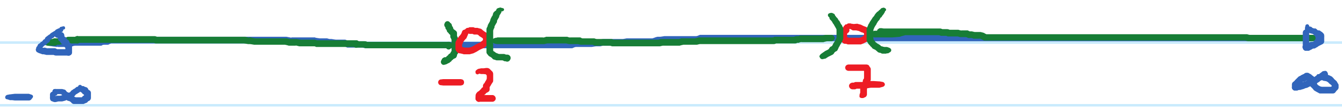
Step 1: Set $x^2 - 5x - 14 = 0$

$$(x-7)(x+2) = 0$$

$$x - 7 = 0 \quad ; \quad x + 2 = 0$$

$$x = 7 \qquad\qquad x = -2$$

Step 2: Domain = Set of all real numbers excluding 7, −2



Domain $= (-\infty, -2) \cup (-2, 7) \cup (7, \infty)$

(B).

11

$$f(x) = \frac{x+6}{x^2 - 36}$$

Step 1: Factor top and bottom

$$= \frac{\cancel{x+6}}{\cancel{(x+6)}(x-6)}$$

Step 2: Cancel common factor(s) if any.

$$= \frac{1}{x-6}$$

Step 3: Set denominator $= 0$ and solve:

$$x - 6 = 0 \longrightarrow x = 6$$

So, vertical asymptote: $\boxed{x = 6}$

(A).

---

12 $f(x) = \dfrac{-10x}{2x^3 + x^2 + 1}$. Horizontal Asymptote.

Degree of top $= 1$

Degree of bottom $= 3$

Since Degree top $<$ Degree bottom, the H.A. is the line $y = 0$ (C)

Short Answer.

(13) $f(x) = -4x^2 + 4x$.

Since $a = -4 < 0$, f has a maximum.

Maximum point = Vertex

$$x \text{ vertex} = -\frac{b}{2a} = -\frac{4}{2(-4)} = \frac{1}{2}$$

$$y \text{ vertex} = -4\left(\frac{1}{2}\right)^2 + 4\left(\frac{1}{2}\right)$$

$$= -4 \cdot \frac{1}{4} + 2 = -1 + 2 = 1$$

Vertex = Maximum point $= \left(\frac{1}{2}, 1\right)$

Answer: $\boxed{\text{Maximum} ; \left(\frac{1}{2}, 1\right)}$

(14)

$$\begin{array}{r|rrrrr} -1 & 1 & 3 & 1 & 4 & 3 \\ & & -1 & -2 & 1 & -5 \\ \hline & 1 & 2 & -1 & 5 & \boxed{-2} \end{array} \rightarrow \text{Remainder.}$$

Quotient $= 1x^3 + 2x^2 - 1x + 5$

Answer:

$$\boxed{\begin{array}{l} \text{Remainder} = -2 \\ \text{Quotient} = x^3 + 2x^2 - x + 5 \end{array}}$$

---

(15)

Degree 3 $\rightarrow$ f has 3 zeros.

So, all the zeros of f are given: $-2, 3, 5$.

Write f in factored form:

$$f(x) = (x+2)(x-3)(x-5)$$

$$= (x^2 - 3x + 2x - 6)(x-5)$$

$$= (x^2 - x - 6)(x-5)$$

$$f(x) = x^3 - 5x^2 - x^2 + 5x - 6x + 30$$

$$\boxed{f(x) = x^3 - 6x^2 - x + 30}$$

Note: The problem did not give any information to find the leading coeff. a. So, we take a = 1.

16

$$f(x) = \frac{x^2 + 3x + 7}{4 - x^2}$$

Degree top = 2

Degree bottom = 2

Degree top = Degree bottom → H.A. $y = \frac{\boxed{a}}{\boxed{b}}$

Leading coeff top

leading coeff. bottom

Leading coeff. top = 1

leading coeff. bottom = −1

Answer: $\boxed{y = \frac{1}{-1} = -1}$

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Essay

17 $f(x) = \dfrac{x^2+4x}{x^2-2x-24}$

$= \dfrac{x\cancel{(x+4)}}{(x-6)\cancel{(x+4)}}$ (Factor top and bottom)

$= \dfrac{x}{x-6}$ ((Cancel))

$x-6=0$ (Set denom. $=0$ and solve)

$x=6$

Conclusion: V.A. is $\boxed{x=6}$

18 Solve $3x^3-29x^2+78x-40=0$

Given 5 is a zero.

Step 1: Synthetic division.

$$\begin{array}{c|cccc} 5 & 3 & -29 & 78 & -40 \\ & & 15 & -70 & 40 \\ \hline & 3 & -14 & 8 & 0 \end{array}$$

So, Quotient $= 3x^2 - 14x + 8$

Step 2: Set quotient $= 0$ and solve

$$3x^2 - 14x + 8 = 0$$

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

$$3x - 2 = 0 \quad ; \quad x - 4 = 0$$

$$3x = 2 \quad ; \quad x = 4$$

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

Conclusion: Solution set : $\boxed{\left\{ \frac{2}{3}, 4, 5 \right\}}$