

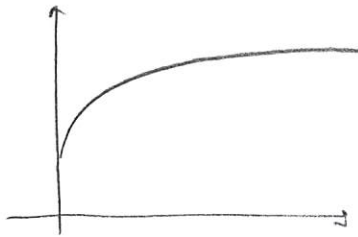
Chapter 9 TEST Calculator Part

Problem

1. The population, P , in thousands, of a small town is modelled by the function $P(t) = \frac{20(4t+3)}{2t+5}$, where t is time, in years, since the start of 1990.

a) Determine the domain and determine with your calculator if the population is increasing or decreasing. Justify your answer by drawing a rough shape of the graph on the domain.

$$D = [0; +\infty[$$



increasing

b) The town will need its own transit system if the population exceeds 50 000. Will the town's population ever exceed 50 000? Justify your answer.

$$\lim_{t \rightarrow +\infty} P(t) = 40$$

\Rightarrow horizontal asymptote: $y = 40$

\Rightarrow The population will never exceed 40 000

\Rightarrow No.

2. Solve. $\frac{x}{2x+5} + 2x = \frac{8x+15}{4x+10}$

• Restr: $2x+5 \neq 0$

$4x+10 \neq 0$

$\Rightarrow D = \mathbb{R} \setminus \{-5/2\}$

• Resol: $\frac{2x}{2(2x+5)} + \frac{4x(2x+5)}{2(2x+5)} = \frac{8x+15}{2(2x+5)}$

$$2x + 4x(2x+5) = 8x+15$$

$$2x + 8x^2 + 20x = 8x+15$$

$$8x^2 + 14x - 15 = 0$$

$$\Delta = 676$$

$$x = \frac{-14 \pm 26}{16}$$

$\nearrow -5/2 \times$ Restr
 $\searrow 3/4 \checkmark$

solution: $\left\{ \frac{3}{4} \right\}$

Chapter 9 TEST
No Calculator Part
Multiple Choice

Identify the choice that best completes the statement or answers the question.

B 3. Which of the reciprocal functions has a vertical asymptote with equation $x = \frac{9}{2}$?

A. $f(x) = \frac{1}{2x+9}$

C. $f(x) = \frac{9}{x+2}$

B. $f(x) = \frac{1}{2x-9}$

D. $f(x) = \frac{1}{x+\frac{9}{2}}$

B 4. What is true about the behaviour of the function $f(x) = \frac{1}{4x+5}$ as $x \rightarrow -\frac{5}{4}$ (from the right side)?

A. $f(x) \rightarrow -\infty$

C. $f(x) \rightarrow 0$

B. $f(x) \rightarrow +\infty$

D. $f(x)$ is undefined



A 5. What is the x -intercept of $f(x) = \frac{1}{2x+4}$?

A. There is no x -intercept.

C. -2

B. $-\frac{1}{2}$

D. 0

A 6. Which of the following functions has an oblique asymptote when graphed?

A. $f(x) = \frac{5x^3 - 10x^2 + 5}{3x^2 - x - 2}$

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

B. $f(x) = \frac{5x^3 - x - 2}{x^3 - 1}$

D. all of the above

C 7. Which function has a y -intercept of $-\frac{8}{27}$?

A. $f(x) = \frac{-8}{x^2 - 12x - 27}$

C. $f(x) = \frac{-8}{x^2 + 12x + 27}$

B. $f(x) = \frac{8}{(-8x+3)(x+9)}$

D. all of the above

D 8. Which function has a horizontal asymptote with equation $y = \frac{2}{7}$?

A. $f(x) = \frac{-2x-3}{7x+8}$

C. $f(x) = \frac{7x-3}{2x+8}$

B. $f(x) = \frac{7x+8}{2x-3}$

D. $f(x) = \frac{2x-3}{7x+8}$

Short Answer

9. a) Which rational function has the following characteristics?

- a vertical asymptote with equation $x = 2$
- a horizontal asymptote with equation $y = 8$
- a zero when $x = -1$
- a point of discontinuity at 3

$$y = \frac{8(x+1)(x-3)}{(x-2)(x-3)}$$

b) Write an equation for a rational function whose graph has all of the following features:

- vertical asymptote with equation $x = 3$
- horizontal asymptote with equation $y = 2$
- hole at $x = 1$
- x-intercepts: -1 and 5

$$y = \frac{2(x+1)(x-5)(x-1)}{(x-3)^2(x-1)}$$

10. Consider the function $f(x) = \frac{x+3}{x^2-x-12}$.

a) Determine the key features of the function:

i) domain

$$D = \mathbb{R} \setminus \{-3; 4\}$$

$$x^2 - x - 12 = (x-4)(x+3)$$

ii) intercepts

$$x\text{-intercept: } \emptyset$$

$$y\text{-intercept: } -\frac{1}{4}$$

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

ii) intercepts

iii) equations of any asymptotes or point of discontinuity.

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

0.5

vertical asymptote : $x=4$

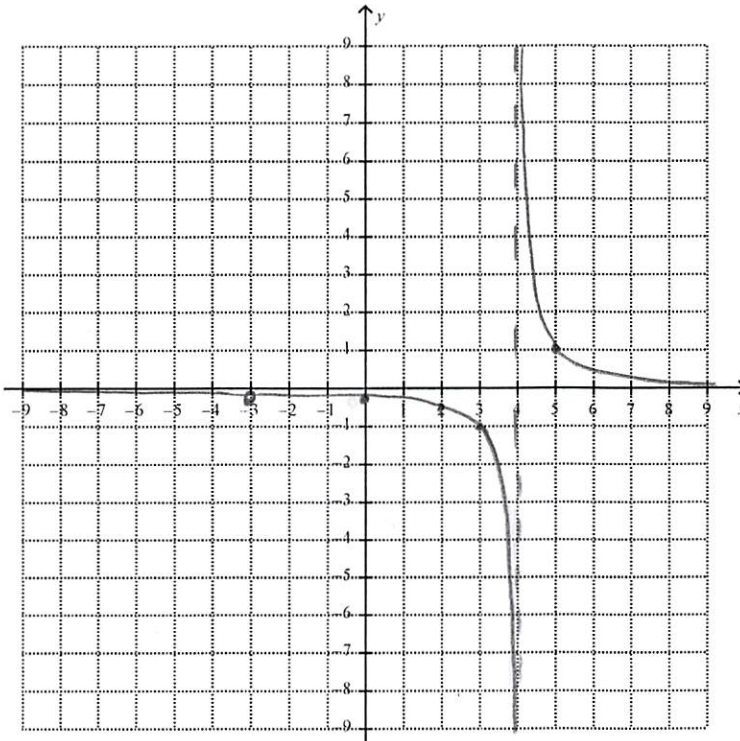
0.5

horizontal asymptote : $y=0$

1

point of discontinuity : $(-3; -\frac{1}{7})$

b) Sketch the graph of the function.



x	2	3	5
y	-1/2	-1	1

2

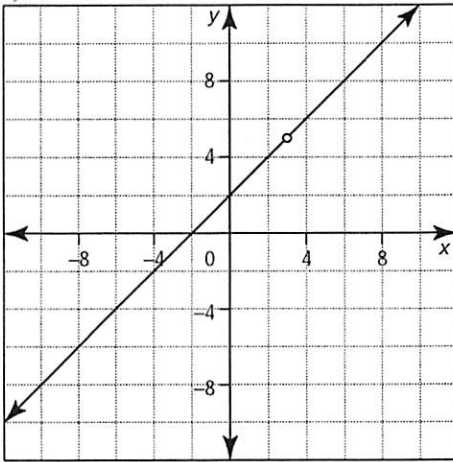
c) Determine the range:

$$R = \mathbb{R} \setminus \{0; -\frac{1}{7}\}$$

1

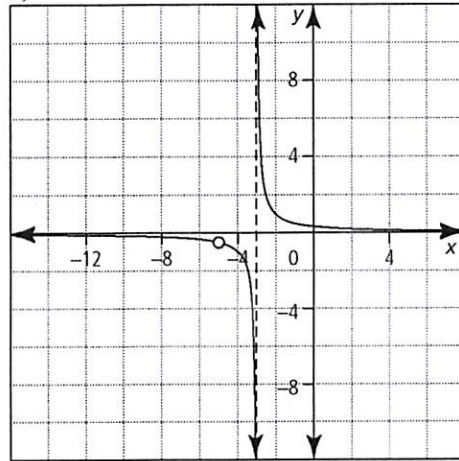
11. Write an equation in factored form for the graph of the rational functions shown.

a)



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

b)



$$y = \frac{(x+5)}{(x+3)(x+5)}$$

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