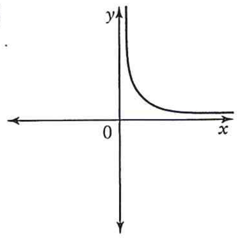
EX 3.2 (p.164 – 166) # 1 – 12

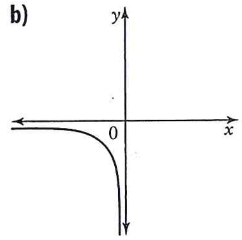
Communicate Your Understanding

C1 Describe the slope and change in slope for each graph.

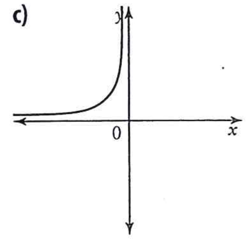
a)



b)



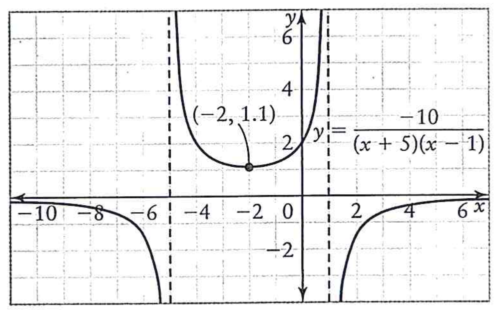
c)



C2 A reciprocal of a quadratic function has the following summary table. Sketch a possible graph of the function.

Interval	$x < -3$	$-3 < x < 1$	$x = 1$	$1 < x < 5$	$x > 5$
Sign of $f(x)$	+	−	−	−	+
Sign of Slope	+	+	0	−	−
Change in Slope	+	−	−	−	+

C3 Describe the key features of the function shown.



A Practise

For help with questions 1 and 2, refer to Example 1.

1. Copy and complete each table to describe the behaviour of the function as x approaches each key value.

a) $f(x) = \dfrac{1}{(x-3)(x-1)}$

As $x \rightarrow$	$f(x) \rightarrow$
3^-	
3^+	
1^-	
1^+	
$-\infty$	
$+\infty$	

b) $f(x) = \dfrac{1}{(x-5)(x+4)}$

As $x \rightarrow$	$f(x) \rightarrow$
-4^-	
-4^+	
5^-	
5^+	
$-\infty$	
$+\infty$	

c) $f(x) = -\dfrac{1}{(x+6)^2}$

As $x \rightarrow$	$f(x) \rightarrow$
-6^-	
-6^+	
$-\infty$	
$+\infty$	

2. Determine equations for the vertical asymptotes, if they exist, for each function. Then, state the domain.

a) $g(x) = \dfrac{1}{(x-4)^2}$

b) $f(x) = \dfrac{1}{(x-2)(x+7)}$

c) $v(x) = \dfrac{1}{x^2+1}$

d) $m(x) = \dfrac{3}{x^2-25}$

e) $h(x) = \dfrac{1}{x^2-4x+3}$

f) $k(x) = -\dfrac{2}{x^2+7x+12}$

g) $n(x) = -\dfrac{2}{3x^2+2x-8}$

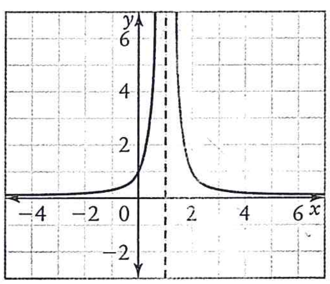
h) $u(x) = -\dfrac{2}{2x^2+3x+8}$

For help with questions 3 and 4, refer to Example 2.

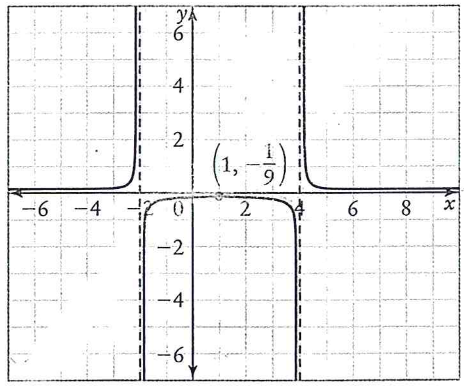
3. Make a summary table with the headings shown for each graph.

Interval	
Sign of Function	
Sign of Slope	
Change in Slope	

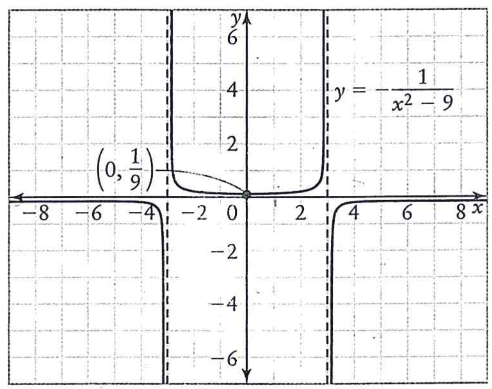
a)



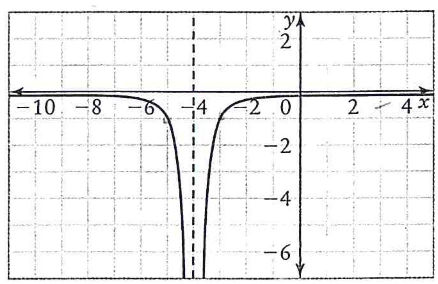
b)



c)



d)



4. Determine a possible equation for each function in question 3.

B Connect and Apply

For help with question 5, refer to Example 3.

5. For each function,

i) give the domain

ii) determine equations for the asymptotes

iii) determine the y-intercepts

iv) sketch a graph of the function

v) include a summary table of the slopes

vi) give the range

a) $f(x) = \dfrac{1}{x^2-9}$

b) $t(x) = \dfrac{1}{x^2-2x-15}$

c) $p(x) = -\dfrac{1}{x^2+5x-21}$

d) $w(x) = \dfrac{1}{3x^2-5x-2}$

e) $q(x) = \dfrac{1}{x^2+2}$

6. For each function in question 5, approximate the instantaneous rate of change at each y-intercept.

7. Recall that a quadratic function with a double zero is tangent to the x-axis at its vertex. Describe the key features of the reciprocal of a perfect square quadratic function, after investigating the graphs of the following functions.

a) $f(x) = \dfrac{1}{x^2}$

b) $g(x) = \dfrac{1}{(x-1)^2}$

c) $h(x) = \dfrac{1}{(x+2)^2}$

8. Sketch each function. Then, determine the intervals where the function is increasing and those where it is decreasing.

a) $f(x) = \dfrac{1}{x^2 - 1}$

b) $c(x) = \dfrac{1}{x^2 + 8x + 15}$

c) $q(x) = \dfrac{4}{x^2 + x - 6}$

d) $h(x) = -\dfrac{1}{4x^2 - 4x - 3}$

e) $w(x) = \dfrac{8}{x^2 + 1}$

f) $g(x) = -\dfrac{1}{(x-6)^2}$

g) $k(x) = -\dfrac{1}{x^2 + 3}$

h) $m(x) = \dfrac{1}{9x^2 - 6x + 1}$

9. **a)** Describe how to find the vertex of the parabola defined by the function $f(x) = x^2 + 6x + 11$.

b) Explain how to use your method in part a) to find the maximum point of the function $g(x) = \dfrac{1}{x^2 + 6x + 11}$.

c) Use your technique to sketch a graph of each function.

i) $h(x) = \dfrac{4}{2x^2 - 8x + 9}$

ii) $k(x) = -\dfrac{5}{x^2 + 5x + 8}$

10. Without graphing, describe the similarities and differences between the graphs of the functions in each pair. Check your answers by graphing.

a) $f(x) = \dfrac{1}{x^2 - 7x + 12}$, $g(x) = -\dfrac{1}{x^2 - 7x + 12}$

b) $h(x) = \dfrac{1}{x^2 - 9}$, $k(x) = \dfrac{2}{x^2 - 9}$

c) $m(x) = \dfrac{1}{x^2 - 4}$, $n(x) = \dfrac{1}{x^2 - 25}$

11. Each function described below is the reciprocal of a quadratic function. Write an equation to represent each function.

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a) The horizontal asymptote is $y = 0$.
The vertical asymptotes are $x = 2$ and $x = -3$.
For the intervals $x < -3$ and $x > 2$, $y > 0$.

b) The horizontal asymptote is $y = 0$.
There is no vertical asymptote.
The maximum point is $(0, 0.5)$.
Domain: $\mathbb{R}$

c) The horizontal asymptote is $y = 0$.
The vertical asymptote is $x = -3$.
Domain: $\{x \in \mathbb{R}, x \neq -3\}$

12. **Chapter Problem** Radiation from the Sun keeps us all alive, but with the thinning of the ozone layer, it is important to limit exposure. The intensity of radiation is inversely proportional to the square of the distance that the Sun's rays travel. The formula $I = \dfrac{k}{d^2}$ models the relationship between intensity, I, in watts per square metre (W/m²), and distance, d, in astronomical units (AU). The intensity of radiation from the Sun is 9140 W/m² on Mercury, which is 0.387 AU away.

a) Determine an equation relating the intensity of radiation and the distance from the Sun.

b) Sketch a graph of this relationship.

c) Determine the intensity of radiation and its rate of change on Earth, which is 1 AU from the Sun.