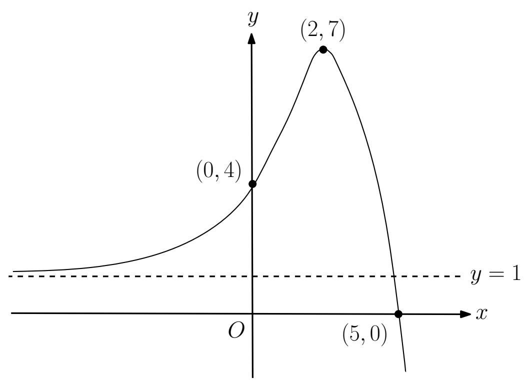
Transformations - Past Edexcel Exam Questions

1. **(Question 5 - C1 May 2018)**



This figure shows the sketch of a curve with equation $y = f(x)$, $x \in \mathbb{R}$. The curve crosses the y-axis at $(0, 4)$ and crosses the x-axis at $(5, 0)$. The curve has a single turning point, a maximum, at $(2, 7)$.

The line with equation $y = 1$ is the only asymptote to the curve.

(a) State the coordinates of the turning point on the curve with equation $y = f(x - 2)$. [1]

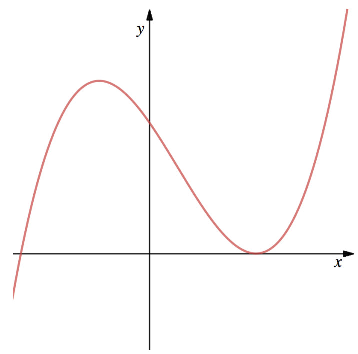
(b) State the solution of the equation $f(2x) = 0$. [1]

(c) State the equation of the asymptote to the curve with equation $y = f(-x)$. [1]

Given that the line with equation $y = k$, where k is a constant, meets the curve $y = f(x)$ at only one point,

(d) state the set of possible values for k. [2]

2. **(Question 10 - C1 May 2017)**



This figure shows a sketch of part of the curve $y = f(x)$, $x \in \mathbb{R}$, where

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

(a) Given that

i. the curve with equation $y = f(x) - k$, $x \in \mathbb{R}$, passes through the origin, find the value of the constant k,

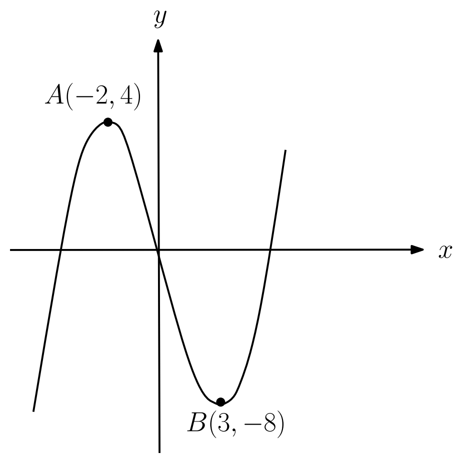
ii. the curve with equation $y = f(x + c)$, $x \in \mathbb{R}$, has a minimum point at the origin, find the value of the constant c. [3]

(b) Show that $f'(x) = 12x^2 - 16x - 35$. (*Differentiation Question*) [3]

Points A and B are distinct points that lie on the curve $y = f(x)$.
The gradient of the curve at A is equal to the gradient of the curve at B. Given that point A has x-coordinate 3,

(c) find the x-coordinate of point B. (*Differentiation Question*) [5]

3. **(Question 4 - C1 May 2016)**



This figure shows a sketch of part of the curve with equation $y = f(x)$. The curve has a maximum point A at $(-2, 4)$ and a minimum point B at $(3, -8)$ and passes through the origin O. On separate diagrams, sketch the curve with equation

(a) $y = 3f(x)$, [2]

(b) $y = f(x) - 4$. [3]

On each diagram, show clearly coordinates of the maximum and minimum points and the coordinates of the point where the curve crosses the y-axis.

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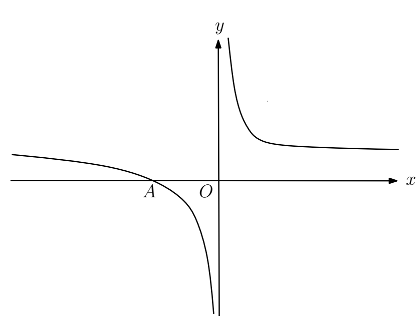
4. **(Question 4 - C1 May 2014)**



This figure shows a sketch of the curve C with equation

$$y = \frac{1}{x} + 1, \qquad x \neq 0$$

The curve C crosses the x-axis at the point A.

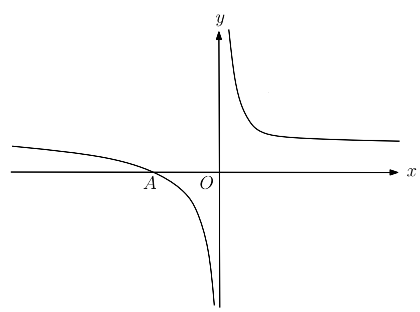
(a) State the x coordinate of the point A. [1]

The curve D has equation $y = x^2(x-2)$, for all real values of x.

(b) A copy of Figure 1 is shown below.

On this copy, sketch a graph of curve D.

Show on the sketch the coordinates of each point where the curve D crosses the coordinate axes. [3]

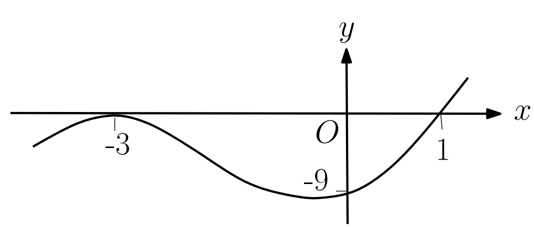


(c) Using your sketch, state, giving a reason, the number of real solutions to the equation

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

[1]

5. **(Question 8 - C1 May 2013)**

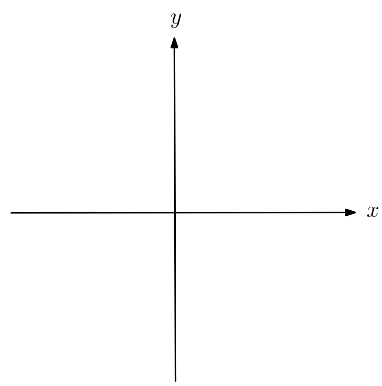


This figure shows a sketch of the curve with equation $y = f(x)$ where

$$f(x) = (x+3)^2(x-1), \quad x \in \mathbb{R}$$

The curve crosses the x-axis at $(1, 0)$, touches it at $(-3, 0)$ and crosses the y-axis at $(0, -9)$.

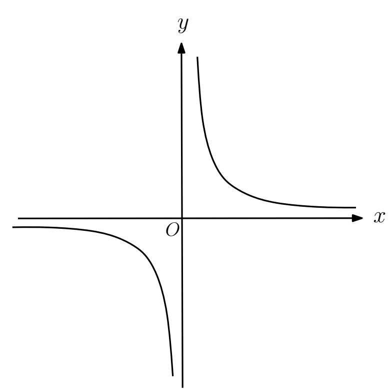
(a) In the space below, sketch the curve C with equation $y = f(x+2)$ and state the coordinates of the points where the curve C meets the x-axis. [3]



(b) Write down an equation of the curve C. [1]

(c) Use your answer to part (b) to find the coordinates of the point where the curve C meets the y-axis. [2]

6. **(Question 6 - C1 Jan 2013)**



This figure shows a sketch of the curve with equation $y = \frac{2}{x}$, $x \neq 0$.

The curve C has equation $y = \frac{2}{x} - 5$, $x \neq 0$, and the line l has equation $y = 4x + 2$.

(a) Sketch and clearly label the graphs of C and l on a single diagram.

On your diagram, show clearly the coordinates of the points where C and l cross the coordinate axes. [5]

(b) Write down the equations of the asymptotes of the curve C. [2]

(c) Find the coordinates of the points of intersection of $y = \frac{2}{x} - 5$ and $y = 4x + 2$. (*Simultaneous Equations Question*) [5]

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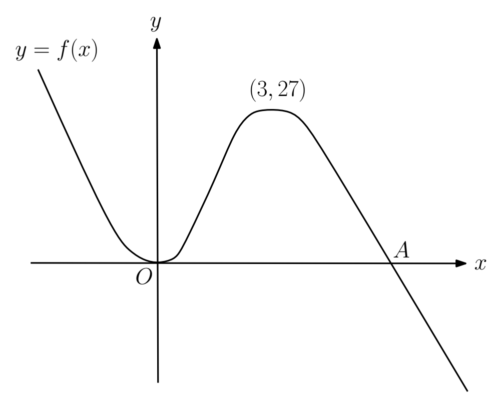
7. **(Question 10 - C1 May 2012)**



This figure shows a sketch of the curve C with equation $y = f(x)$, where

$$f(x) = x^2(9 - 2x).$$

There is a minimum at the origin, a maximum at the point $(3, 27)$ and C cuts the x-axis at the point A.

(a) Write down the coordinates of the point A. [1]

(b) On separate diagrams sketch the curve with equation

i. $y = f(x + 3)$,

ii. $y = f(3x)$.

On each sketch you should indicate clearly the coordinates of the maximum points and any points where the curves cross or meet the coordinate axes. [6]

The curve with equation $y = f(x) + k$, where k is a constant, has a maximum point at $(3, 10)$.

(c) Write down the value of k. [1]

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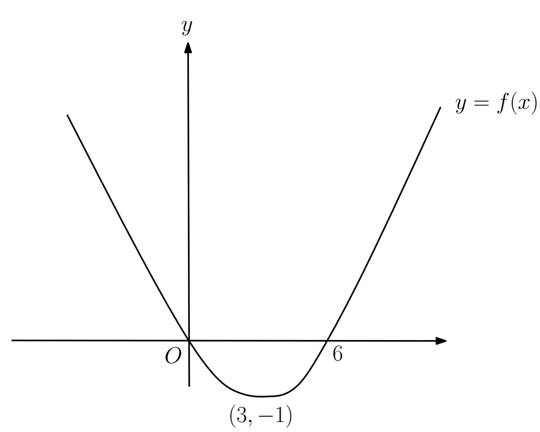
8. **(Question 8 - C1 May 2011)**



This figure shows a sketch of the curve C with equation $y = f(x)$.

The curve C passes through the origin and through $(6, 0)$.
The curve C has a minimum at the point $(3, -1)$.

On separate diagrams, sketch the curve with equation

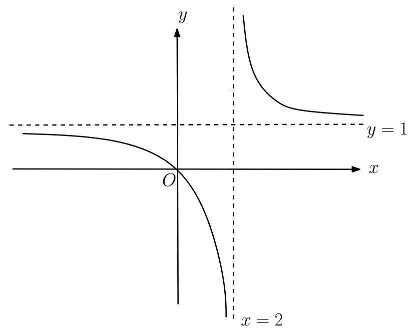
(a) $y = f(2x)$, [3]

(b) $y = -f(x)$, [3]

(c) $y = f(x + p)$, where p is a constant and $0 < p < 3$. [4]

On each diagram show the coordinates of any points where the curve intersects the x-axis and of any minimum or maximum points.

9. **(Question 5 - C1 Jan 2011)**



This figure shows a sketch of the curve with equation $y = f(x)$ where

$$f(x) = \frac{x}{x-2}, \quad x \neq 2$$

The curve passes through the origin and has two asymptotes, with equation $y = 1$ and $x = 2$.

(a) Sketch the curve with equation $y = f(x - 1)$ and state the equations of the asymptotes of this curve. [3]

(b) Find the coordinates of the points where the curve with equation $y = f(x - 1)$ crosses the coordinate axes. [4]

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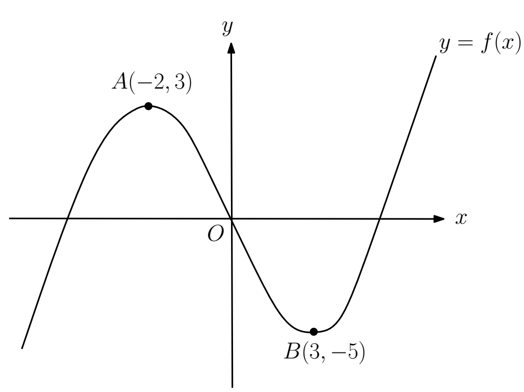
10. **(Question 6 - C1 May 2010)**



This figure shows a sketch of the curve with equation $y = f(x)$. The curve has a maximum point A at $(-2, 3)$ and a minimum point B at $(3, -5)$.

On separate diagrams sketch the curve with equation

(a) $y = f(x + 3)$, [3]

(b) $y = 2f(x)$. [3]

On each diagram show clearly the coordinates of the maximum and minimum points.

The graph of $y = f(x) + a$ has a minimum at (3,0), where a is a constant.

(c) Write down the value of a. [1]

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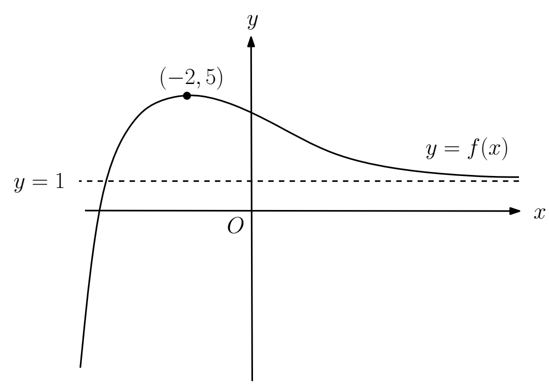
11. **(Question 8 - C1 Jan 2010)**



This figure shows a sketch of part of the curve with equation $y = f(x)$.

The curve has a maximum point $(-2, 5)$ and an asymptote $y = 1$.

On separate diagrams, sketch the curve with equation

(a) $y = f(x) + 2$ [2]

(b) $y = 4f(x)$ [2]

(c) $y = f(x + 1)$ [3]

On each diagram, show clearly the coordinates of the maximum point and the equation of the asymptote.

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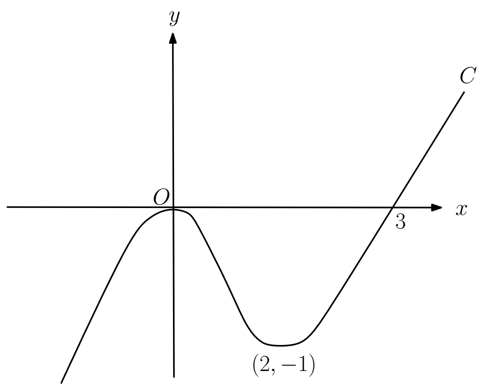
12. **(Question 5 - C1 Jan 2009)**



This figure shows a sketch of the curve C with equation $y = f(x)$. There is a maximum at $(0, 0)$, a minimum at $(2, -1)$ and C passes through $(3, 0)$.

On separate diagrams, sketch the curve with equation

(a) $y = f(x + 3)$, [3]

(b) $y = f(-x)$. [3]

On each diagram, show clearly the coordinates of the maximum point, the minimum point and any points of intersection with the x-axis.

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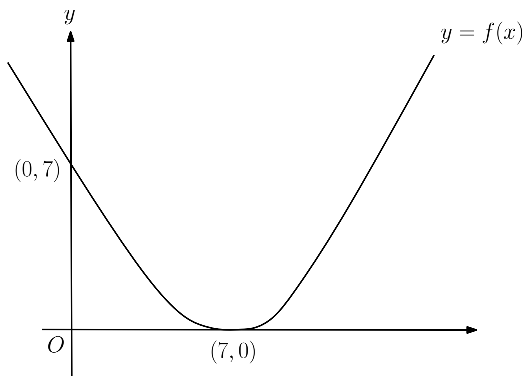
13. **(Question 3 - C1 Jun 2008)**



This figure shows a sketch of the curve with equation $y = f(x)$. The curve passes through the point (0,7) and has a minimum at (7,0).

On separate diagrams, sketch the curve with equation

(a) $y = f(x) + 3$, [3]

(b) $y = f(2x)$. [2]

On each diagram, show clearly the coordinates of the minimum point and the coordinates of the point at which the curve crosses the y-axis.

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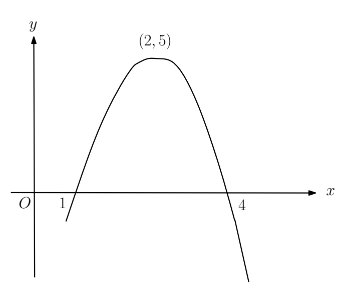
14. **(Question 6 - C1 Jan 2008)**



This figure shows a sketch of the curve with equation $y = f(x)$. The curve crosses the x-axis at the points $(1, 0)$ and $(4, 0)$. The maximum point on the curve is $(2, 5)$.

In separate diagrams, sketch the curves with the following equations. On each diagram show clearly the coordinates of the maximum point and of each point at which the curve crosses the x-axis.

(a) $y = 2f(x)$, [3]

(b) $y = f(-x)$. [3]

The maximum point on the curve with equation $y = f(x + a)$ is on the y-axis.

(c) Write down the value of the constant a. [1]

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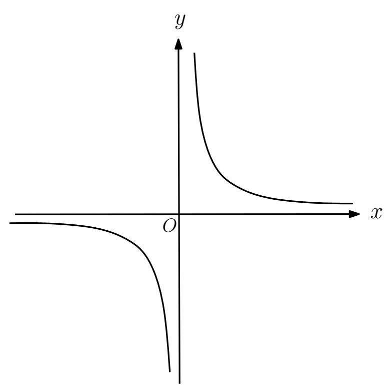
15. **(Question 5 - C1 May 2007)**



This figure shows a sketch of the curve with equation $y = \frac{3}{x}$, $x \neq 0$.

(a) On a separate diagram, sketch the curve with equation $y = \frac{3}{x+2}$, $x \neq -2$, showing the coordinates of any point at which the curve crosses a coordinate axis. [3]

(b) Write down the equations of the asymptotes of the curve in part (a). [2]

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16. **(Question 3 - C1 Jan 2007)**

Given that

$$f(x) = \frac{1}{x}, \qquad x \neq 0$$

(a) sketch the graph of $y = f(x) + 3$ and state the equations of the asymptotes. [4]

(b) Find the coordinates of the point where $y = f(x) + 3$ crosses a coordinate axes. [2]

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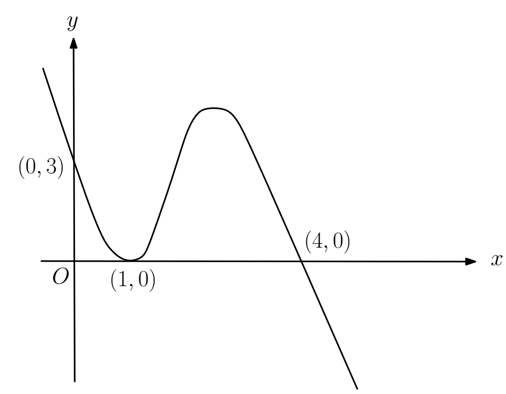
17. **(Question 6 - C1 Jan 2006)**



This figure shows a sketch of the curve with equation $y = f(x)$. The curve passes through the points $(0, 3)$ and $(4, 0)$ and touches the x-axis at the point $(1, 0)$.

On separate diagrams, sketch the curve with equation

(a) $y = f(x + 1)$, [3]

(b) $y = 2f(x)$, [3]

(c) $y = f\left(\frac{1}{2}x\right)$. [3]

On each diagram show clearly the coordinates of all the points at which the curve meets the axes.

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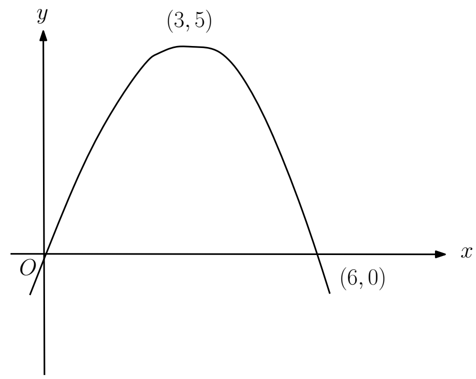
18. **(Question 4 - C1 May 2005)**



This figure shows a sketch of the curve with equation $y = f(x)$. The curve passes through the origin O and through the point $(6, 0)$. The maximum point on the curve is $(3, 5)$.

On separate diagrams, sketch the curve with equation

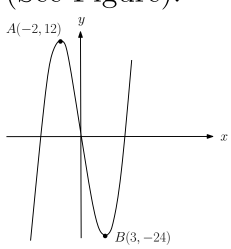
(a) $y = 3f(x)$, [2]

(b) $y = f(x + 2)$. [3]

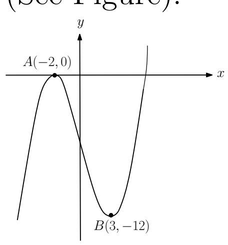
On each diagram, show clearly the coordinates of the maximum point and of each point at which the curve crosses the x-axis.

Solutions

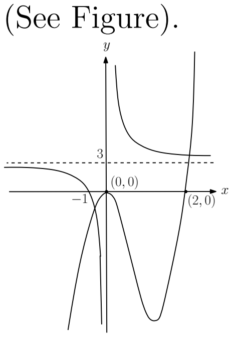
1. (a) $(4, 7)$
   (b) $x = 2.5$
   (c) $y = 1$
   (d) $k < 1$
2. (a) i. $k = 75$
   ii. $c = 2.5$
   (b) - (*Differentiation*)
   (c) $x = \frac{-5}{3}$ (*Differentiation*)
3. (a) (See Figure).



   (b) (See Figure).

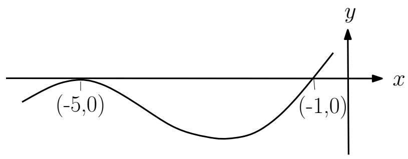


4. (a) $x = -1$
   (b) (See Figure).



(c) There are 2 solutions since the graphs intersect twice.

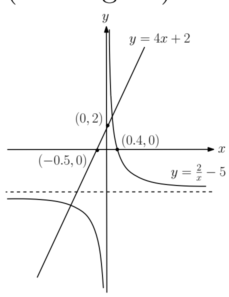
5. (a) (See Figure).



(b) $(x+5)^2(x+1)$

(c) $(0,25)$

6. (a) (See Figure).

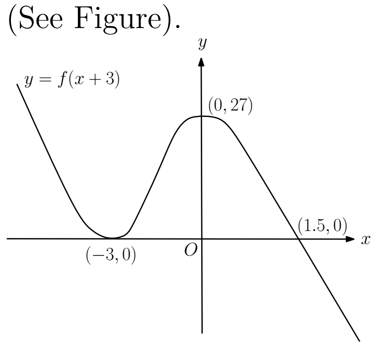


(b) $x = 0$, $y = -5$

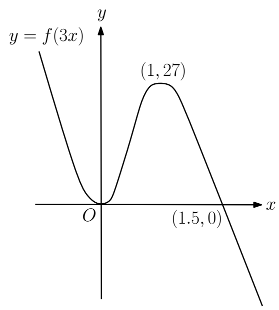
(c) $\left(\frac{1}{4}, 3\right)$, $(-2, -6)$ (*Simultaneous Equations Question*)

7. (a) $\left(\frac{9}{2}, 0\right)$

(b) i. (See Figure).

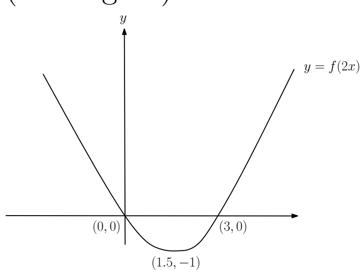


ii. (See Figure).

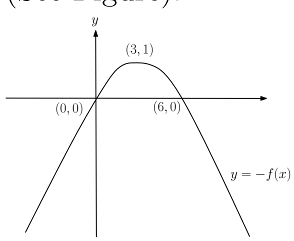


(c) $k = -17$.

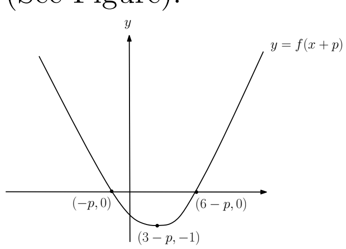
8. (a) (See Figure).



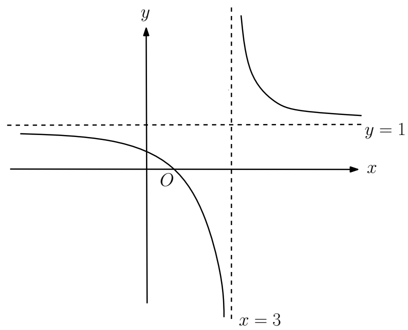
(b) (See Figure).



(c) (See Figure).

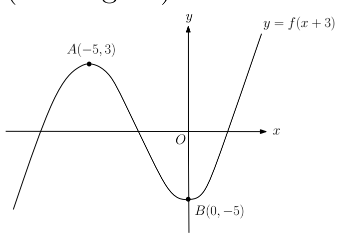


9. (a) (See Figure).

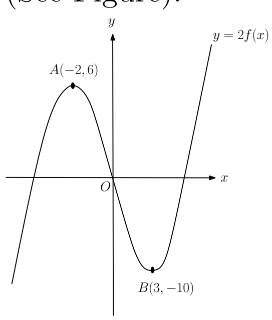


(b) $\left(0, \frac{1}{3}\right)$ and $(1, 0)$

10. (a) (See Figure).

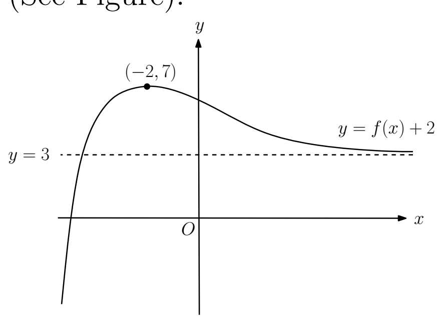


(b) (See Figure).

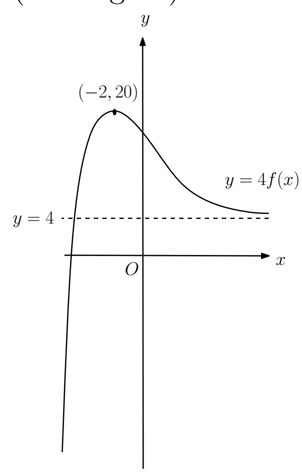


(c) $a = 5$.

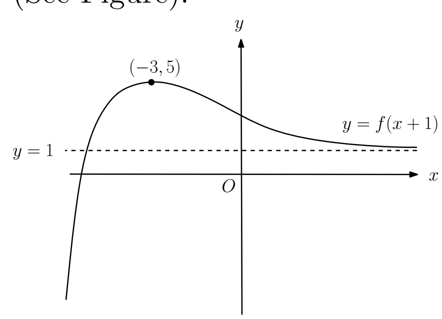
11. (a) (See Figure).



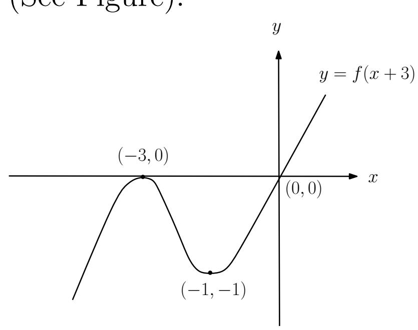
(b) (See Figure).



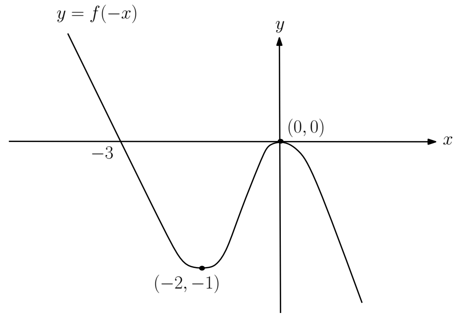
(c) (See Figure).



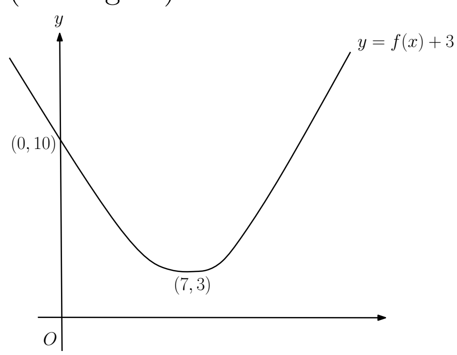
12. (a) (See Figure).



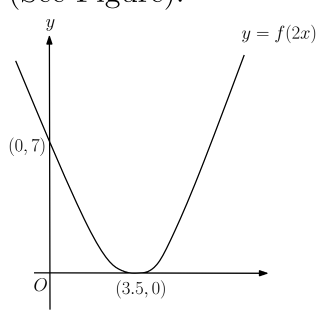
(b) (See Figure).



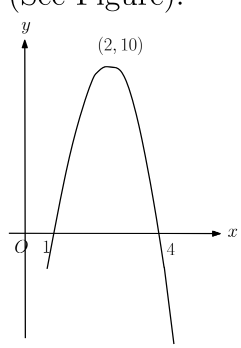
13. (a) (See Figure).



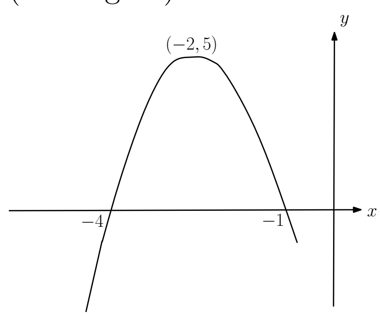
(b) (See Figure).



14. (a) (See Figure).

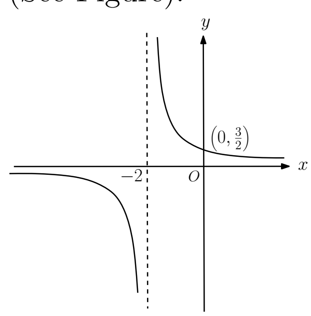


(b) (See Figure).



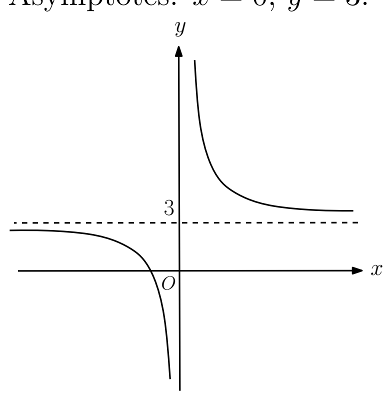
(c) $a = 2$

15. (a) (See Figure).



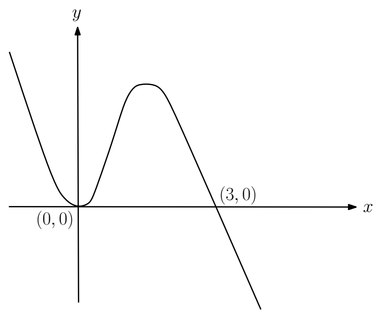
(b) Asymptotes: $x = -2$, $y = 0$

16. (a) Asymptotes: $x = 0$, $y = 3$.

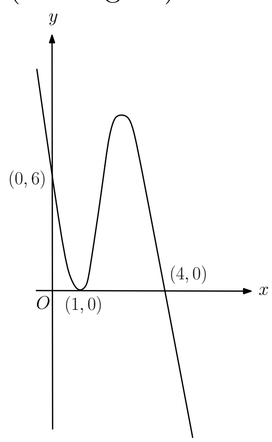


(b) $\left(-\frac{1}{3}, 0\right)$

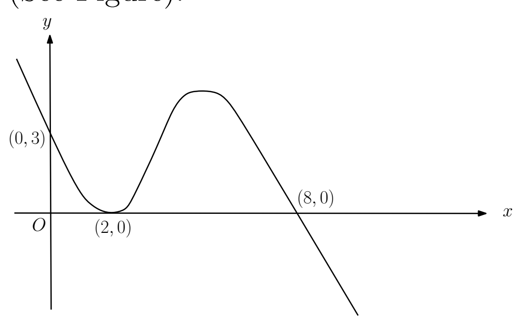
17. (a) (See Figure).



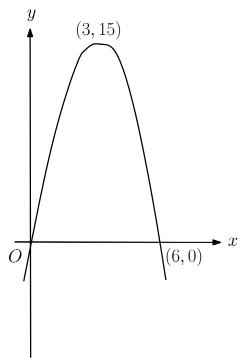
(b) (See Figure).



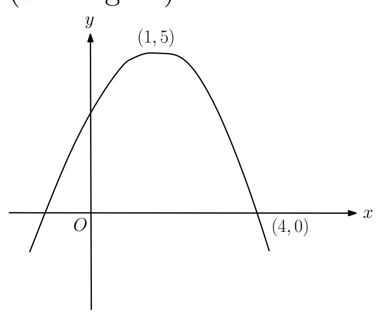
(c) (See Figure).



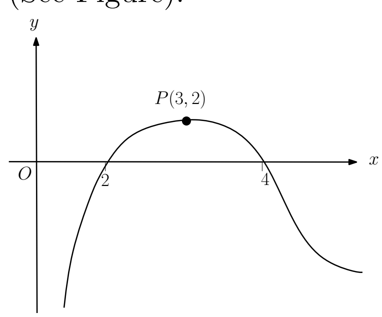
18. (a) (See Figure).



(b) (See Figure).



19. (a) (See Figure).



(b) (See Figure).