3. On separate diagrams, sketch the graphs of

(a) $y = (x + 3)^2$,

(3)

(b) $y = (x + 3)^2 + k$, where k is a positive constant.

(2)

Show on each sketch the coordinates of each point at which the graph meets the axes.

3. Given that

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

(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 axis.
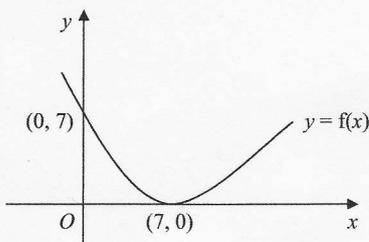
(2)

3.

Figure 1

Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve passes through the point $(0, 7)$ and has a minimum point 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.
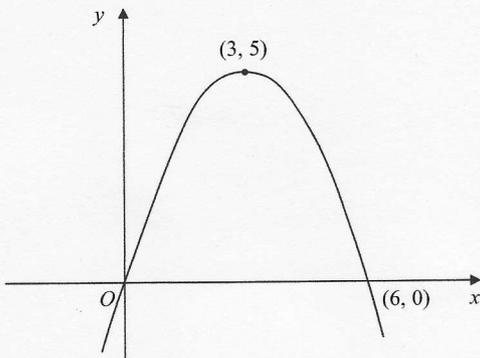
4.

Figure 1

Figure 1 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.

In summary, for the graph of the function $y = f(x)$

| Transformation	Effect
$y = f(x) + a$	Translates $f(x)$ by $\begin{pmatrix} 0 \\ a \end{pmatrix}$
$y = f(x + b)$	Translates $f(x)$ by $\begin{pmatrix} -b \\ 0 \end{pmatrix}$
$y = f(x + b) + a$	Translates $f(x)$ by $\begin{pmatrix} -b \\ a \end{pmatrix}$
$y = kf(x)$	One-way stretch of $f(x)$ parallel to y-axis with a scale factor k. Multiply y-cords by k, x-coords stay same.
$y = f(kx)$	One-way stretch of $f(x)$ parallel to x-axis with a scale factor $1/k$. Multiply x-coords by $1/k$, y-coords stay same.
$y = -f(x)$	Reflects the graph $y = f(x)$ in the x-axis
$y = f(-x)$	Reflects the graph $y = f(x)$ in the y-axis

5.
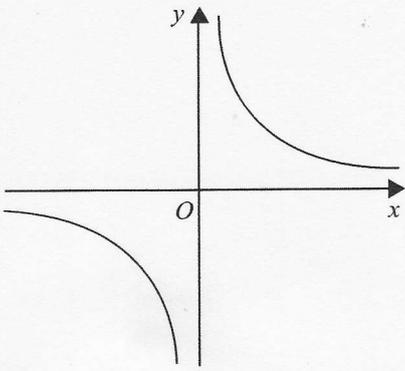
Figure 1

Figure 1 shows a sketch of the curve with equation $y = \dfrac{3}{x}$, $x \neq 0$.

(a) On a separate diagram, sketch the curve with equation $y = \dfrac{3}{x+2}$, $x \neq -2$,

showing the coordinates of any point at which the curve crosses a coordinate axis.

(3)

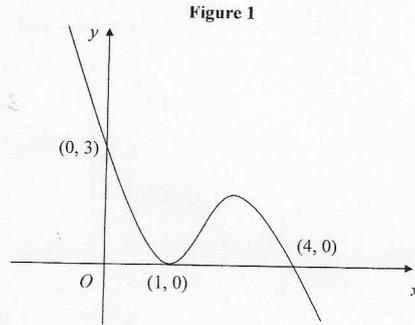(b) Write down the equations of the asymptotes of the curve in part (a).

(2)

6

Figure 1

Figure 1 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) $y = f\left(\dfrac{1}{2}x\right)$.

(3)

On each diagram show clearly the coordinates of all the points at which the curve meets the axes.
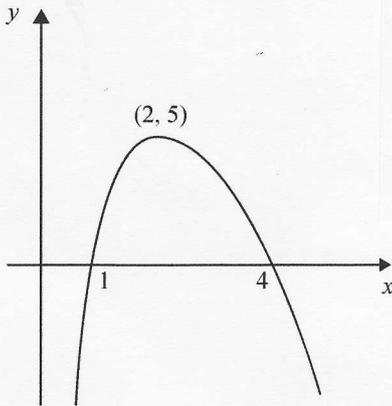
Q6

Figure 1

Figure 1 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.