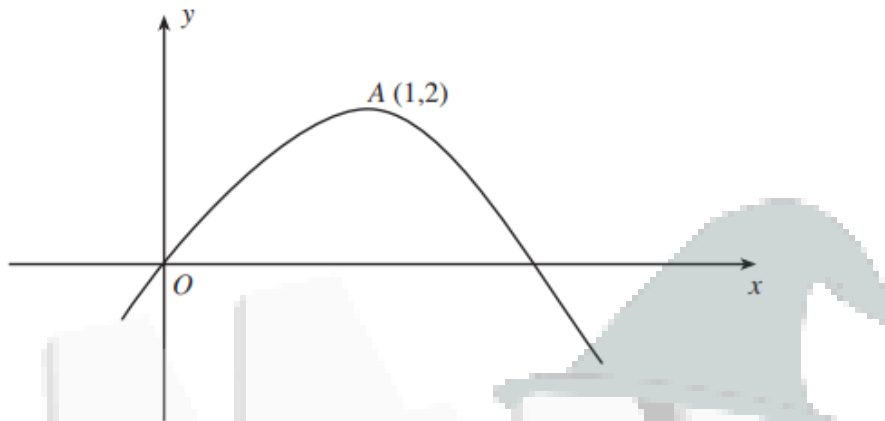


C1 Transformation Questions

2005 Winter

9.



The diagram shows the graph of $y = f(x)$. The curve passes through the origin, and has a maximum point at $(1, 2)$.

Sketch on separate diagrams the graphs of

- (a) $y = f(x) + 4$, (b) $y = f(x + 3)$, (c) $y = f(2x)$,

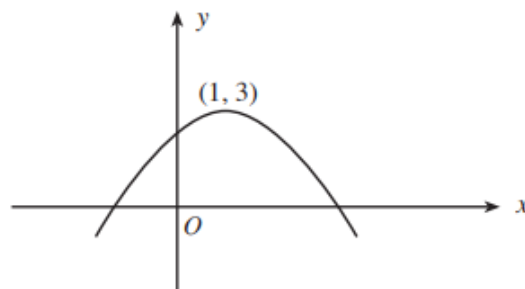
giving the coordinates of the maximum point in each case.

[2], [2], [2]

2005 Summer

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10. The diagram shows the graph of $y = f(x)$. The graph has a maximum point at $(1, 3)$.



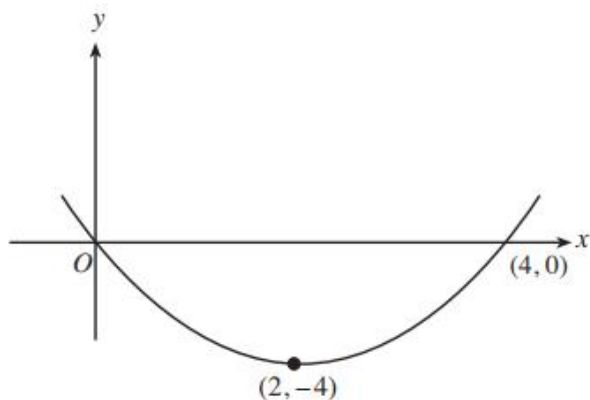
Sketch the following graphs, using a separate set of axes for each graph and indicating the coordinates of the stationary point in each case.

- (a) $y = 4f(x)$ (b) $y = f(x - 2)$ (c) $y = f\left(\frac{x}{2}\right)$

[2], [2], [2]

2006 Winter

4.



The diagram shows the graph of $y = f(x)$. The curve passes through the origin, the point $(4, 0)$ and has a minimum point at $(2, -4)$. Sketch on separate diagrams the graphs of

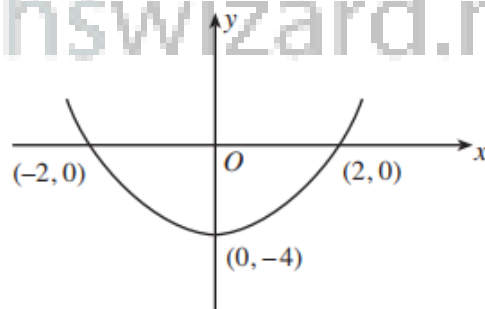
(a) $y = -f(x)$, [2]

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

in each case giving the coordinates of the points of intersection of the graph with the x -axis and the coordinates of the stationary point.

2006 Summer

9.



The diagram shows the graph of $y = f(x)$. The curve passes through the points $(2, 0)$ and $(-2, 0)$, and has a minimum point at $(0, -4)$.

Sketch on separate diagrams the graphs of

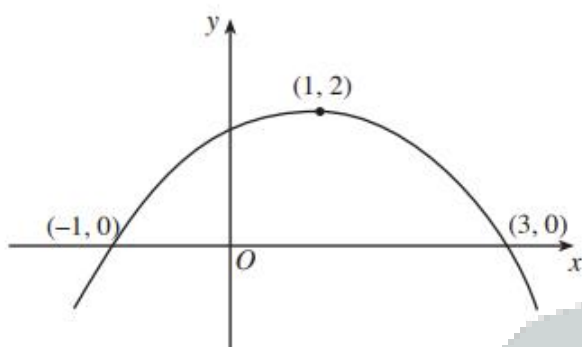
(a) $y = f(x) + 4$, [2]

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

indicating the coordinates of the points of intersection with the x -axis and the coordinates of the stationary points.

2007 Summer

9.



The diagram shows the graph of $y = f(x)$. The graph passes through the points $(-1, 0)$ and $(3, 0)$ and has a maximum point at $(1, 2)$.

Sketch, on separate diagrams, the graphs of

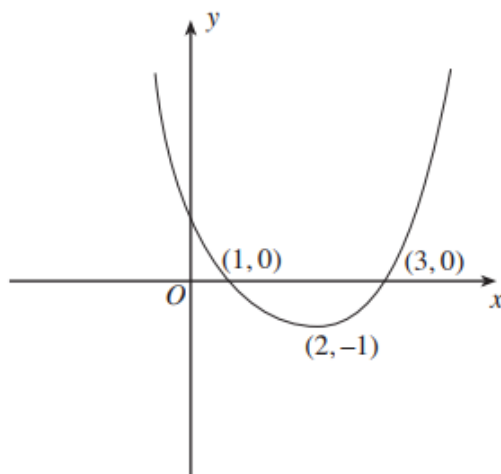
(a) $y = f(x - 3)$, [3]

(b) $y = f\left(\frac{x}{2}\right)$, [3]

showing the stationary points and the points of intersection of the graphs with the x -axis.

2008 Winter

9. The diagram shows the graph of $y = f(x)$. The graph has a minimum point at $(2, -1)$ and intersects the x -axis at the points $(1, 0)$ and $(3, 0)$.

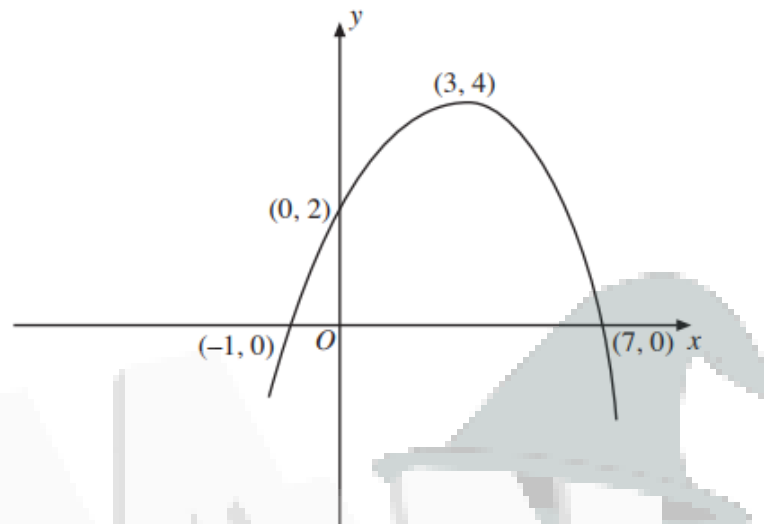


Sketch the following graphs, using a separate set of axes for each graph. In each case you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

(a) $y = 3f(x)$ (b) $y = f(x + 5)$ [3], [3]

2008 Summer

8. The diagram shows a sketch of the graph of $y = f(x)$. The graph has a maximum point at $(3, 4)$ and intersects the x -axis at the points $(-1, 0)$ and $(7, 0)$ and the y -axis at the point $(0, 2)$.

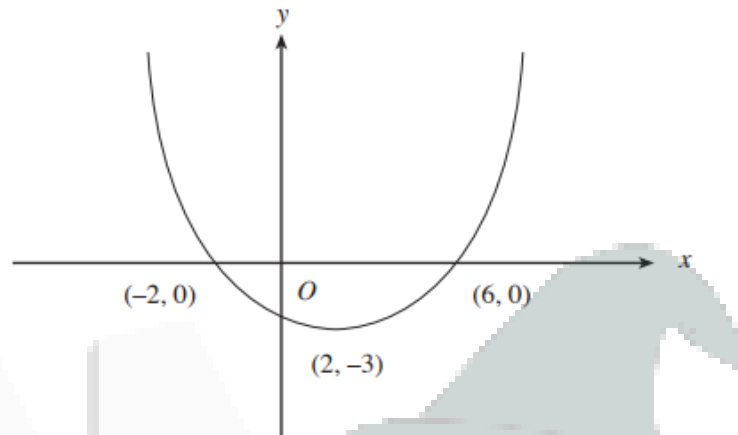


- (a) Sketch the graph of $y = f(x + 2)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) Sketch the graph of $y = f(x) + 3$, indicating the coordinates of the stationary point and the coordinates of the point of intersection of the graph with the y -axis. [3]

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2009 Winter

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-2, 0)$ and $(6, 0)$ and has a minimum point at $(2, -3)$.



Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

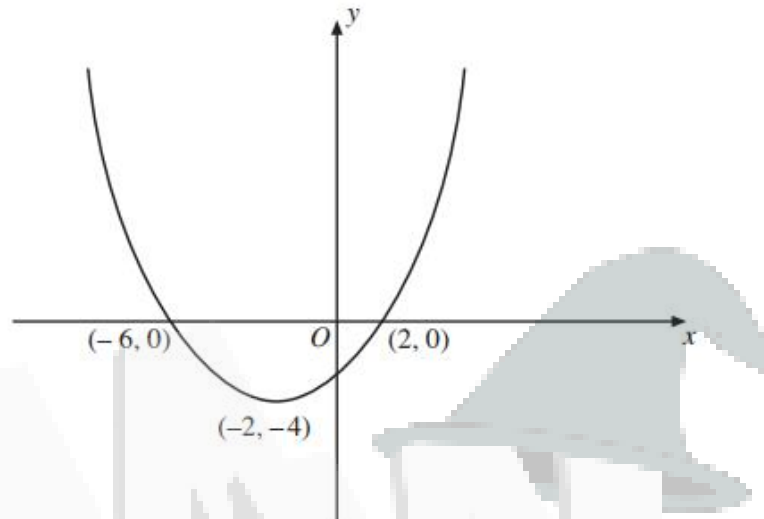
(a) $y = f(x - 3)$, [3]

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

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2009 Summer

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-6, 0)$ and $(2, 0)$, and has a minimum point at $(-2, -4)$.



Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

- (a) $y = f(x+1)$ [3]
- (b) $y = f(2x)$ [3]

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9. Figure 1 shows a sketch of the graph of $y = f(x)$. The graph has a maximum point at $(2, 5)$ and intersects the x -axis at the points $(-2, 0)$ and $(6, 0)$.

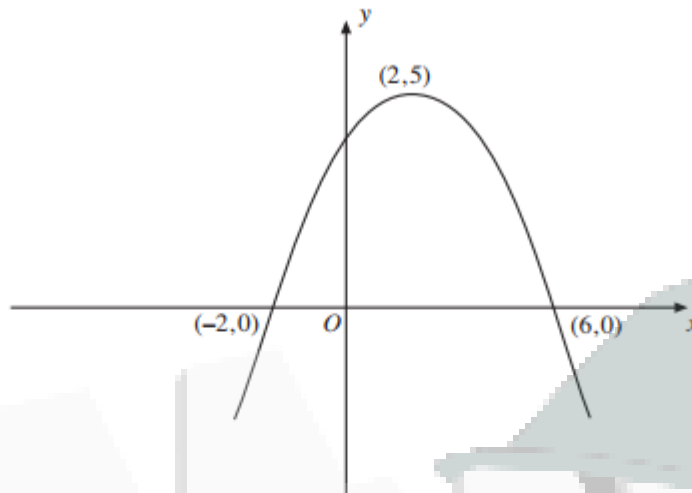


Figure 1

- (a) Sketch the graph of $y = f\left(\frac{x}{2}\right)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) Figure 2 shows a sketch of the graph having **one** of the following equations with an appropriate value of either p , q or r .

$y = f(x + p)$, where p is a constant
 $y = f(x) + q$, where q is a constant
 $y = rf(x)$, where r is a constant

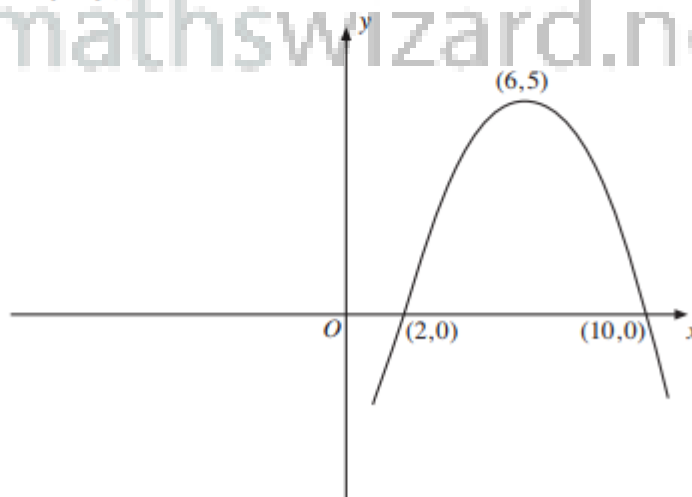
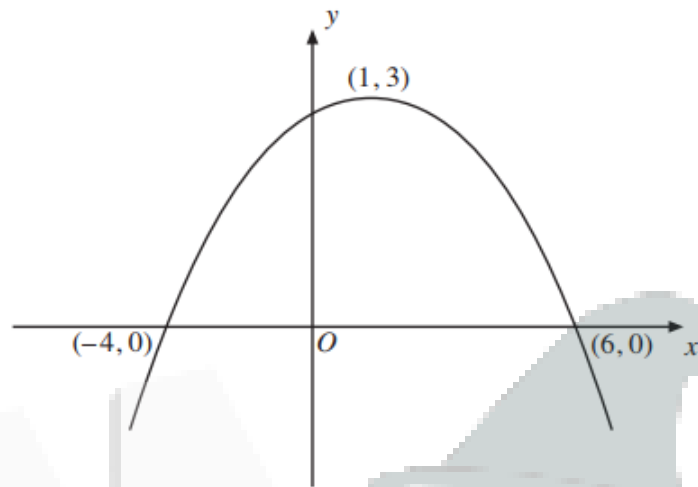


Figure 2

Write down the equation of the graph sketched in Figure 2, together with the value of the corresponding constant. [2]

2010 Summer

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-4, 0)$ and $(6, 0)$ and has a maximum point at $(1, 3)$.



Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

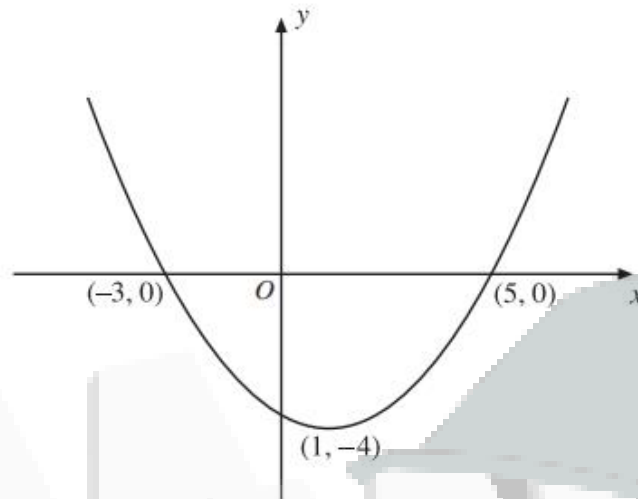
(a) $y = 2f(x)$ [3]

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

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2011 Winter

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-3, 0)$ and $(5, 0)$ and has a minimum point at $(1, -4)$.



Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

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

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

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9. Figure 1 shows a sketch of the graph of $y = f(x)$. The graph has a minimum point at $(-3, -4)$ and intersects the x -axis at the points $(-8, 0)$ and $(2, 0)$.

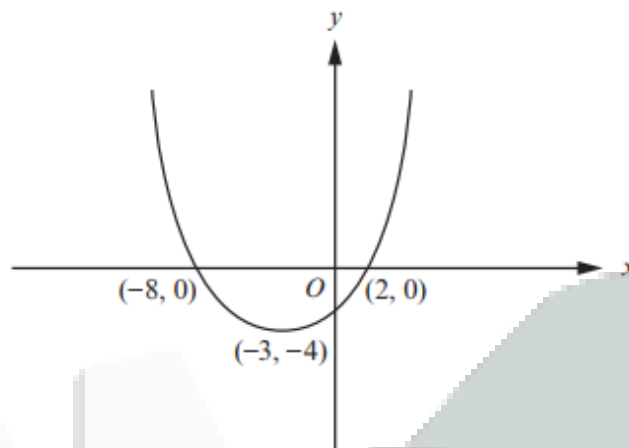


Figure 1

- (a) Sketch the graph of $y = f(x + 3)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) Figure 2 shows a sketch of the graph having **one** of the following equations with an appropriate value of either p , q or r .

$y = f(px)$, where p is a constant
 $y = f(x) + q$, where q is a constant
 $y = rf(x)$, where r is a constant.

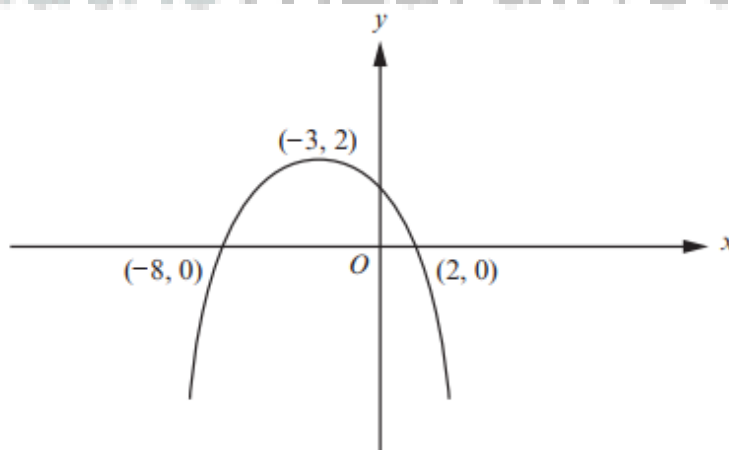
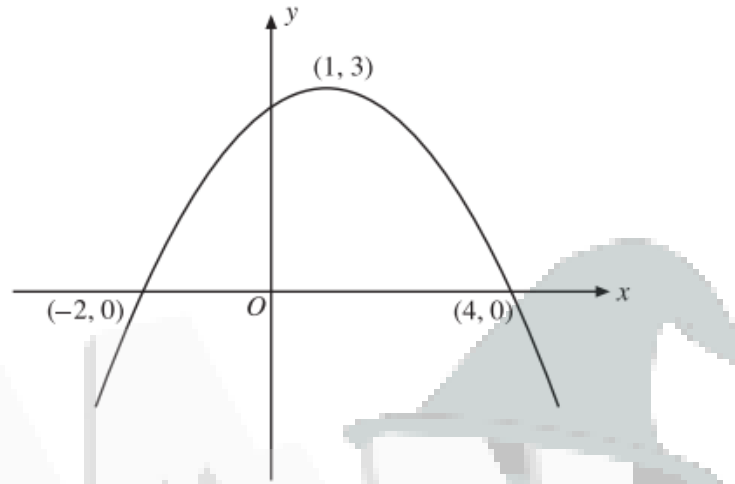


Figure 2

Write down the equation of the graph sketched in Figure 2, together with the value of the corresponding constant. [2]

2012 Winter

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph has a maximum point at $(1, 3)$ and intersects the x -axis at the points $(-2, 0)$ and $(4, 0)$.

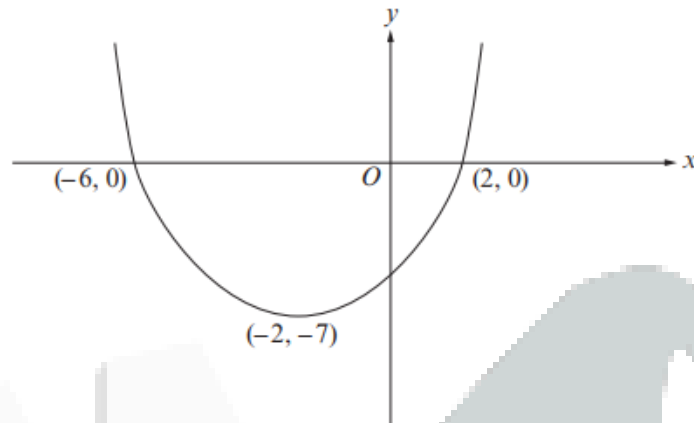


- (a) Sketch the graph of $y = f(2x)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) (i) Sketch the graph of $y = f(x) - 5$, indicating the coordinates of the stationary point.
- (ii) Given that f is a quadratic function, use the graph you have drawn in part (i) to write down the number of real roots of the equation

$f(x) - 5 = 0$. [3]

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9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-6, 0)$ and $(2, 0)$ and has a minimum point at $(-2, -7)$.



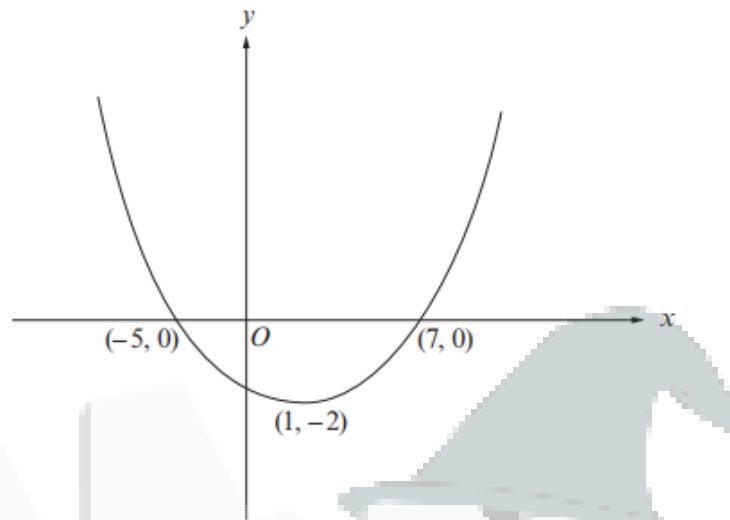
Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

(a) $y = f(x - 5)$ [3]

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

2013 Winter

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-5, 0)$ and $(7, 0)$ and has a minimum point at $(1, -2)$.



Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

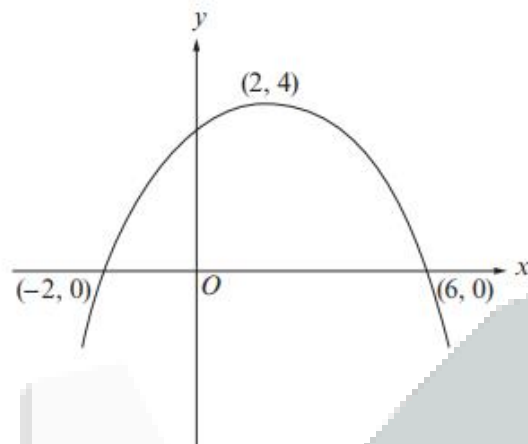
(a) $y = 3f(x)$ [3]

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

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2013 Summer

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-2, 0)$ and $(6, 0)$ and has a maximum point at $(2, 4)$.



Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

(a) $y = f(x + 5)$ [3]

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

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7. **Figure 1** shows a sketch of the graph of $y = f(x)$. The graph has a maximum point at $(2, 6)$ and intersects the x -axis at the points $(-4, 0)$ and $(8, 0)$.

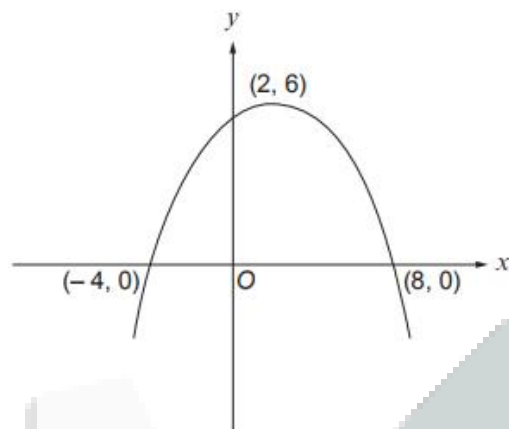


Figure 1

- (a) Sketch the graph of $y = f(x - 3)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) **Figure 2** shows a sketch of the graph having **one** of the following equations with an appropriate value of p , q or r .

$y = f(x) + p$, where p is a constant
 $y = f(qx)$, where q is a constant
 $y = rf(x)$, where r is a constant

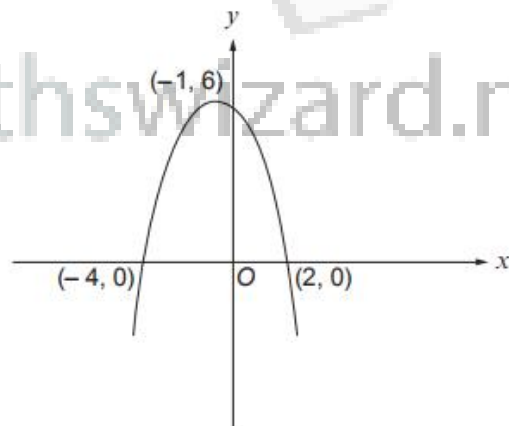
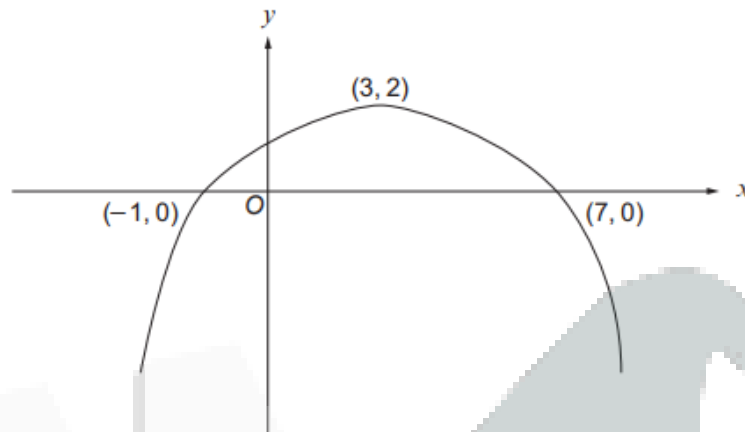


Figure 2

Write down the equation of the graph sketched in **Figure 2**, together with the value of the corresponding constant. [2]

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-1, 0)$ and $(7, 0)$ and has a maximum point at $(3, 2)$.



- (a) Sketch the following graphs, using a separate set of axes for each graph. In each case, you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis.

(i) $y = f(x + 4)$

(ii) $y = -2f(x)$

[6]

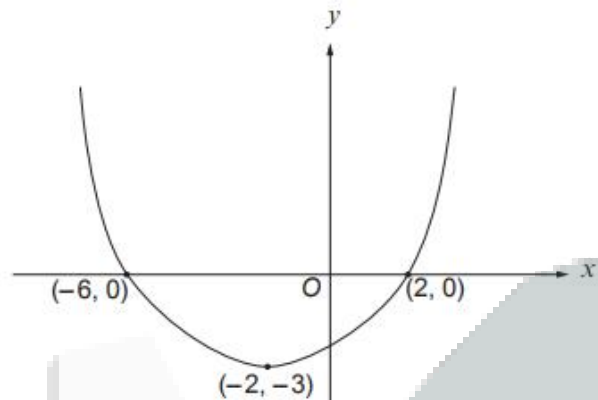
- (b) Hence write down one root of the equation

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

[1]

2015

9. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-6, 0)$ and $(2, 0)$ and has a minimum point at $(-2, -3)$.



- (a) Sketch the graph of $y = f\left(\frac{1}{2}x\right)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) Angharad is asked by her teacher to draw the graph of $y = af(x)$ for various non-zero values of the constant a . One of Angharad's graphs passes through the origin O. Explain why this cannot possibly be correct. [1]

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7. Figure 1 shows a sketch of the graph of $y = f(x)$. The graph has a minimum point at $(1, -3)$ and intersects the x -axis at the points $(-4, 0)$ and $(6, 0)$.

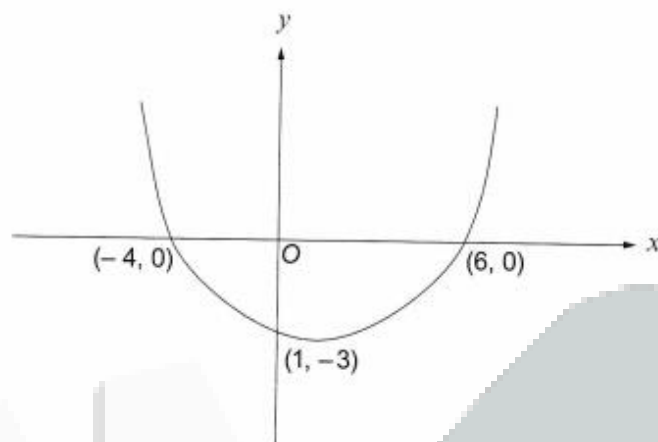


Figure 1

- (a) Sketch the graph of $y = -3f(x)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) Figure 2 shows a sketch of the graph of $y = g(x)$, where
 $g(x) = f(x) + p$, where p is a constant,
 or $g(x) = f(qx)$, where q is a constant,
 or $g(x) = rf(x)$, where r is a constant,
 or $g(x) = f(x + s)$, where s is a constant.

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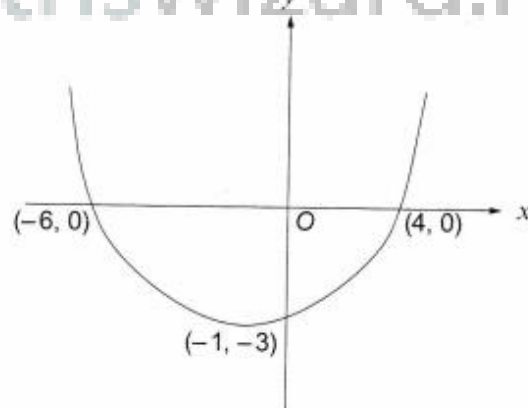
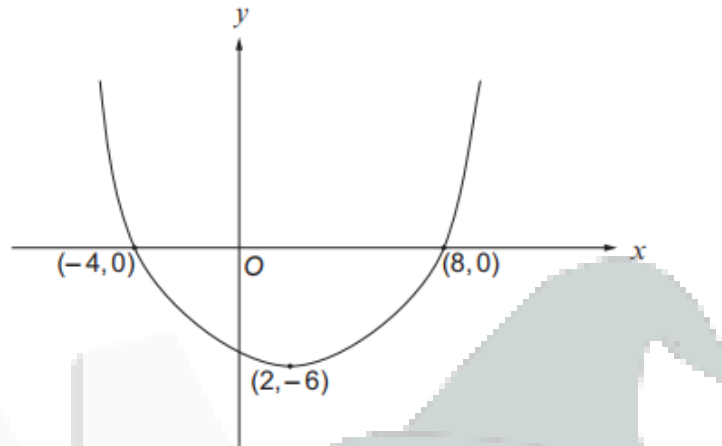


Figure 2

The function g can in fact be any one of **two** of the above functions. In each of these two cases, write down the expression for $g(x)$, including the value of the corresponding constant. [2]

2017

8. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-4, 0)$ and $(8, 0)$ and has a minimum point at $(2, -6)$.



- (a) Sketch the graph of $y = -\frac{1}{2}f(x)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) Siân is asked by her teacher to draw the graph of $y = f(ax)$ for various non-zero values of the constant a . Write down two facts about the stationary point on Siân's graph which will always be true whatever her choice of a . [2]

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