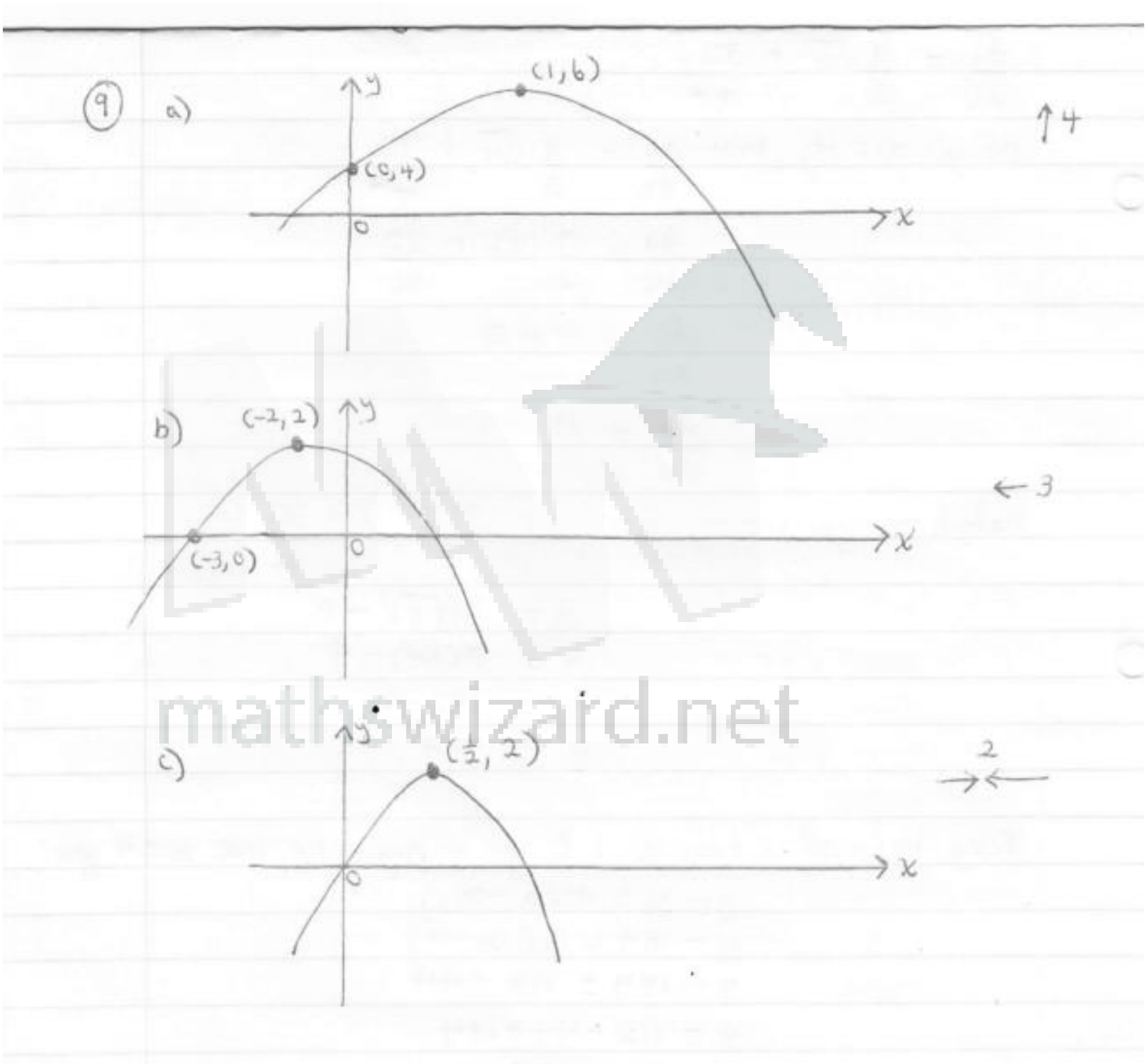
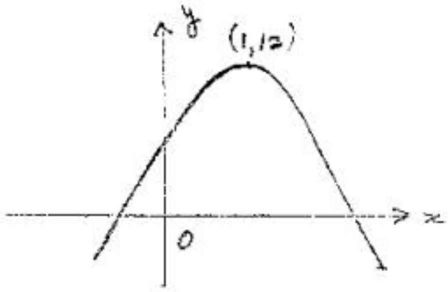
C1 Transformation Questions

2005 Winter



2005 Summer

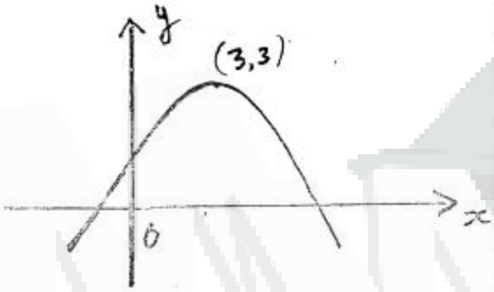
10. (a)



M1 (stationary point coordinates)

A1 (+ve y, –ve x intercepts)

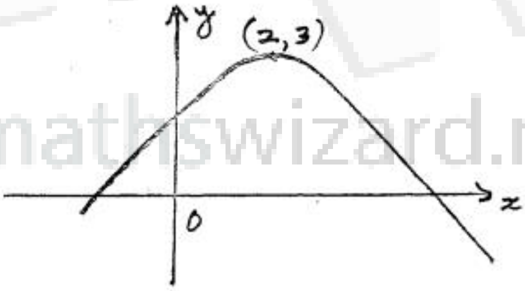
(b)



M1 ($y = 3, x \neq 1$)

A1 ($x = 3$)

(c)



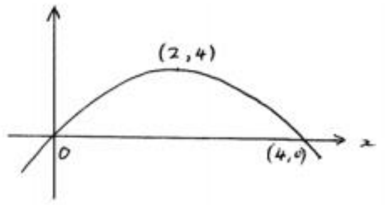
M1 (stationary point correct)

A1 (+ve y, –ve x intercepts)

[6]

2006 Winter

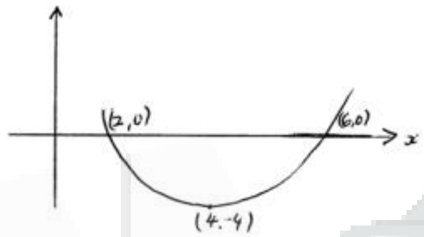
4. (a)



M1 (reflection in x – axis)

A1 (correct points)

(b)



M1 (x translation to right)

B1 (st.pt) (on diagram or stated)

A1 (points of intersection)

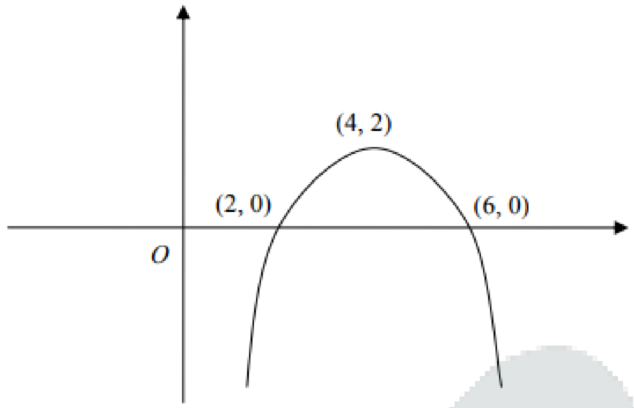
5

2006 Summer

9.	(a)	Translation along y-axis so that stationary point is $(0, a)$, $a = 0, -8$	M1
		Correct translation and stationary point at (0, 0)	A1
	(b)	Translation of 2 units to left along x-axis	M1
		Stationary point is (–2, –4)	A1
		Points of intersection with x-axis are (–4, 0) and (0, 0)	A1
		Special case	
		Translation of 2 units to right along x-axis with correct labelling	B1

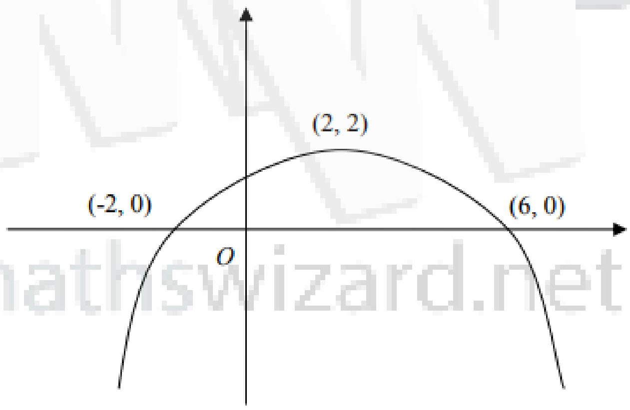
2007 Summer

9. (*a*)



Concave down curve with stationary point at $(a, 2)$, $a \neq 1$ B1
$a = 4$ B1
Points of intersection with x-axis (2, 0), (6, 0) B1

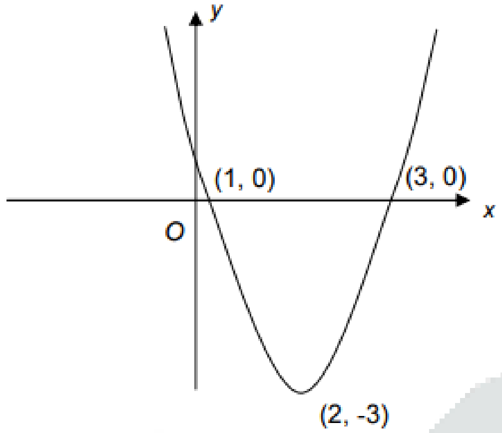
(*b*)



Concave down curve with positive intercept on y-axis B1
Stationary point (2, 2) B1
Points of intersection with x-axis (–2, 0), (6, 0) B1

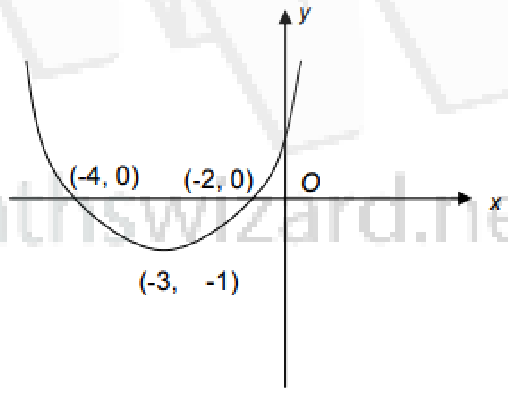
2008 Winter

9. (*a*)



Concave up curve and minimum point = (2, *k*) with *k* < –1 B1
Minimum point = (2, –3) B1
Both points of intersection with *x*-axis B1

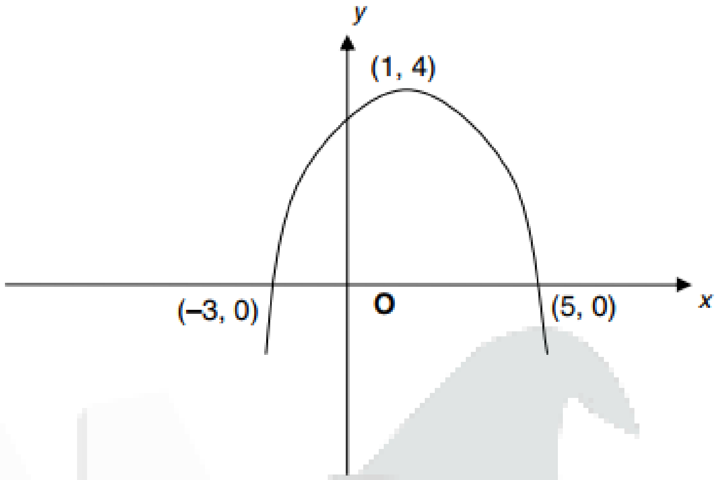
(*b*)



Concave up curve and *y*-coordinate of minimum = –1 B1
x-coordinate of minimum = –3 B1
Both points of intersection with *x*-axis B1

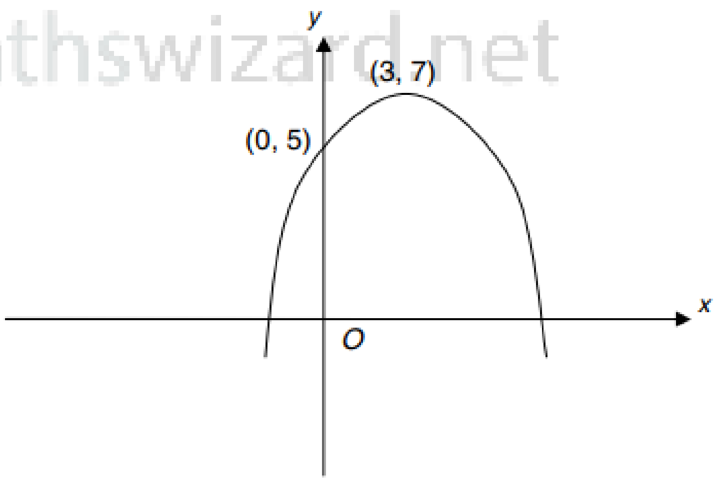
2008 Summer

8. (*a*)



Concave down curve with maximum (1, 4) or (5, 4)	B1
Two of the three points correct	B1
All three points correct	B1

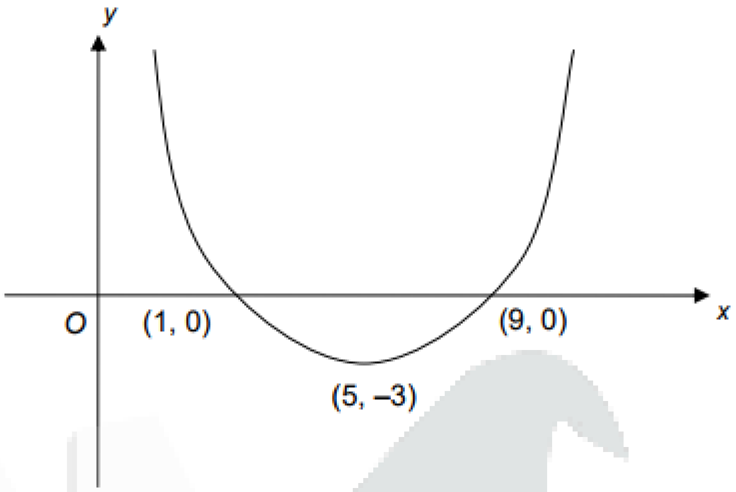
(*b*)



Concave down curve with maximum (3, 7) or (3, 1)	B1
Maximum point (3, 7)	B1
Point of intersection with y-axis (0, 5)	B1

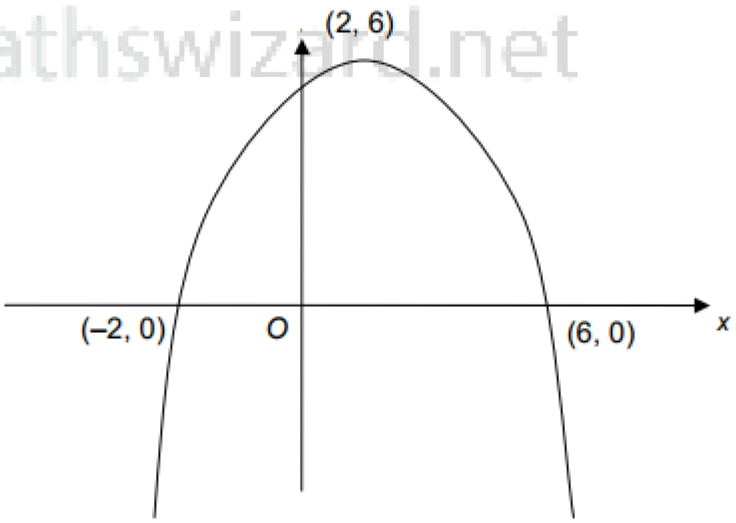
2009 Winter

9. (*a*)



Concave up curve and y-coordinate of minimum = –3 B1
x-coordinate of minimum = 5 B1
Both points of intersection with x-axis B1

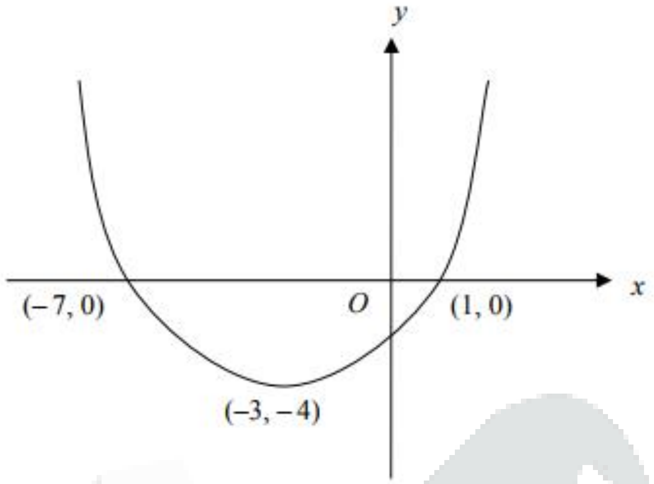
(*b*)



Concave down curve and x-coordinate of maximum = 2 B1
y-coordinate of maximum = 6 B1
Both points of intersection with x-axis B1

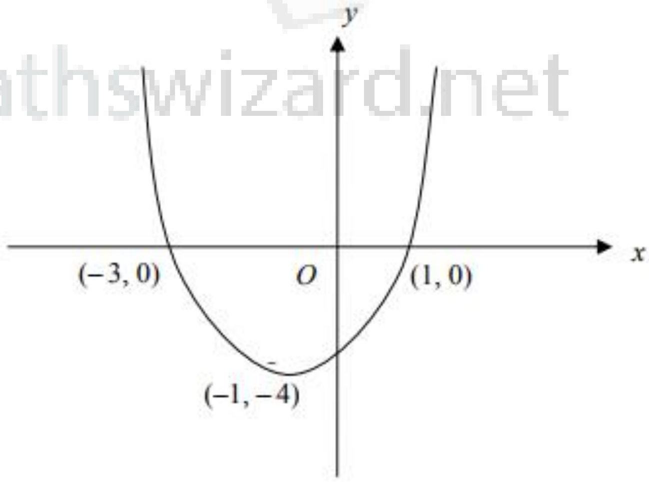
2009 Summer

9. (*a*)



Concave up curve and y-coordinate of minimum = – 4 B1
x-coordinate of minimum = – 3 B1
Both points of intersection with x-axis B1

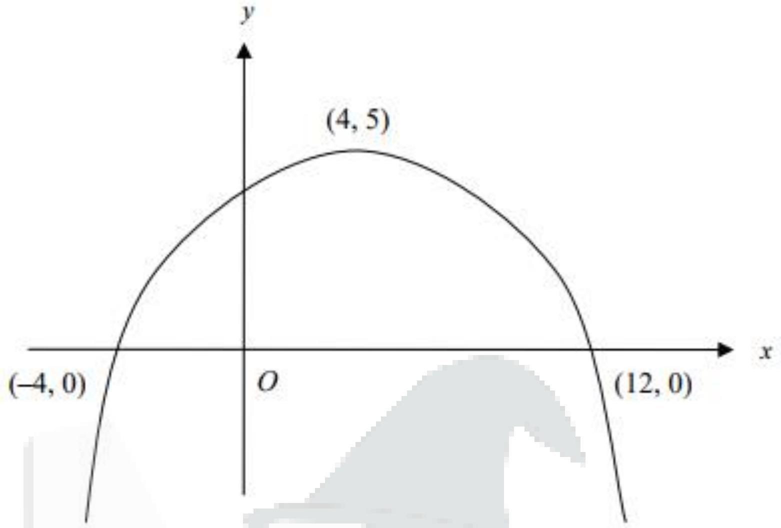
(*b*)



Concave up curve and y-coordinate of minimum = – 4 B1
x-coordinate of minimum = – 1 B1
Both points of intersection with x-axis B1

2010 Winter

9. (*a*)



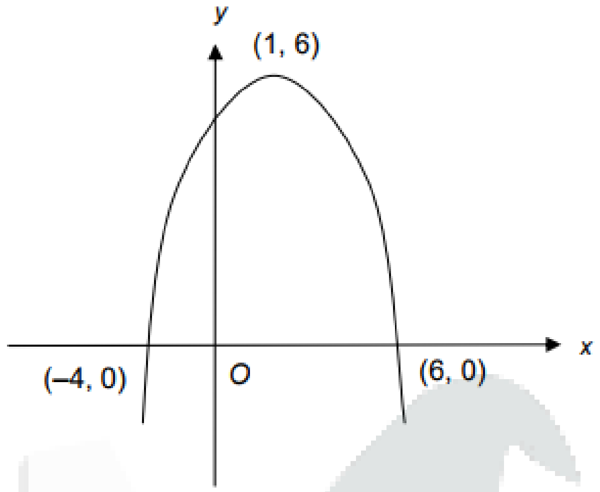
Concave down curve and y-coordinate of maximum = 5	B1
x-coordinate of maximum = 4	B1
Both points of intersection with x-axis	B1

(*b*)

$y = f(x - 4)$	B2
If B2 not awarded	
$y = f(x + 4)$	B1

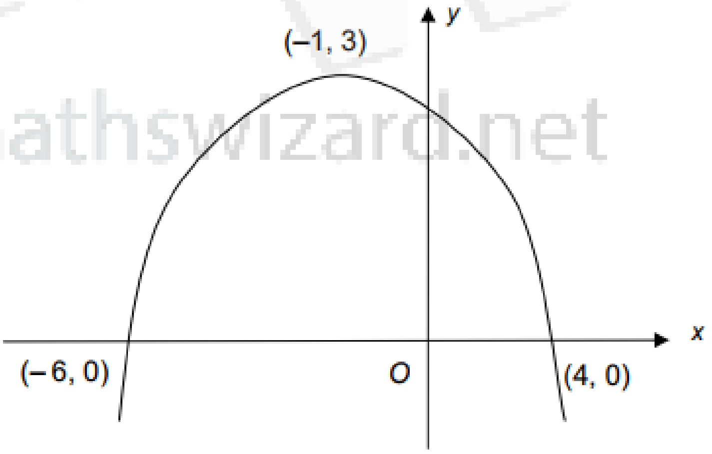
2010 Summer

9. (*a*)



Concave down curve with maximum at $(1, a)$, $a \neq 3$ B1
Maximum at $(1, 6)$ B1
Both points of intersection with x-axis B1

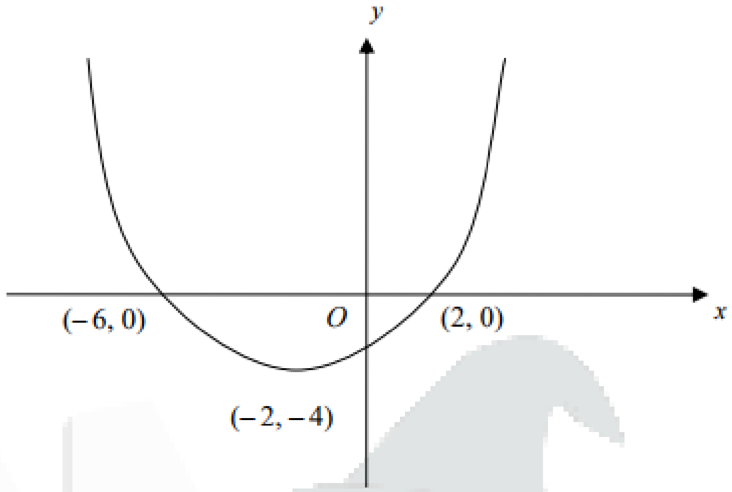
(*b*)



Concave down curve with maximum at $(b, 3)$, $b \neq 1$ B1
Maximum at $(-1, 3)$, B1
Both points of intersection with x-axis B1

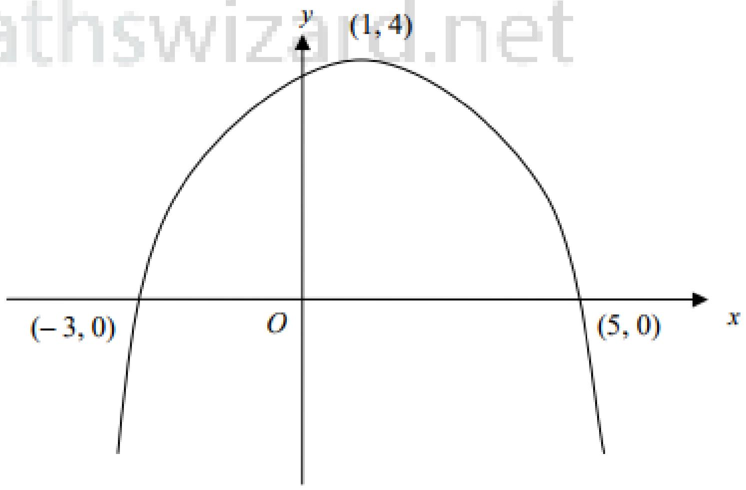
2011 Winter

9. (*a*)



Concave up curve and y-coordinate of minimum = – 4	B1
x-coordinate of minimum = – 2	B1
Both points of intersection with x-axis	B1

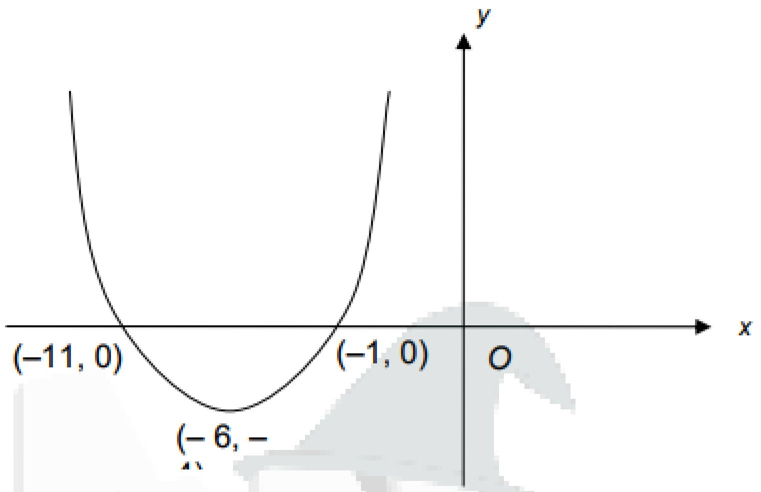
(*b*)



Concave down curve and x-coordinate of maximum = 1	B1
y-coordinate of maximum = 4	B1
Both points of intersection with x-axis	B1

2011 Summer

9. (*a*)



Concave up curve and y-coordinate of minimum = – 4	B1
x-coordinate of minimum = – 6	B1
Both points of intersection with x-axis	B1

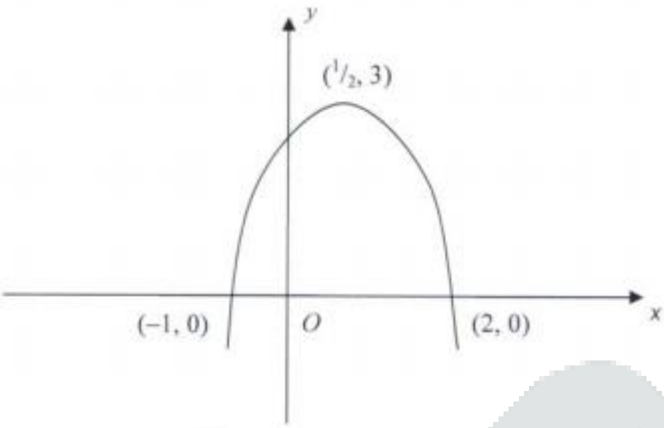
(*b*) $y = -\frac{1}{2}f(x)$ B2

If B2 not awarded

$y = rf(x)$ with r negative B1

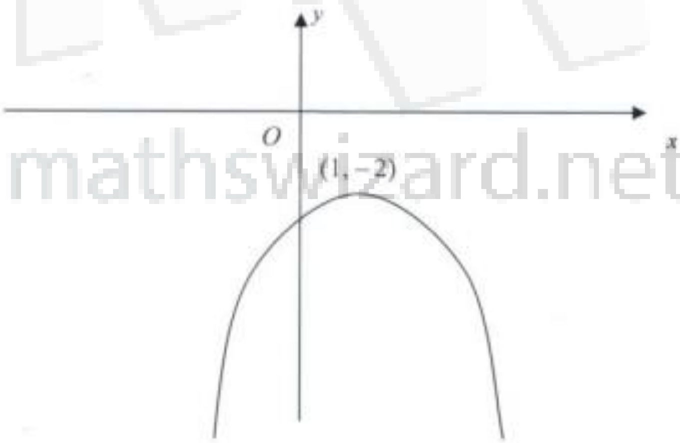
2012 Winter

9. (*a*)



Concave down curve with y-coordinate of maximum = 3	B1
x-coordinate of maximum = $^1/_2$	B1
Both points of intersection with x-axis	B1

(*b*)

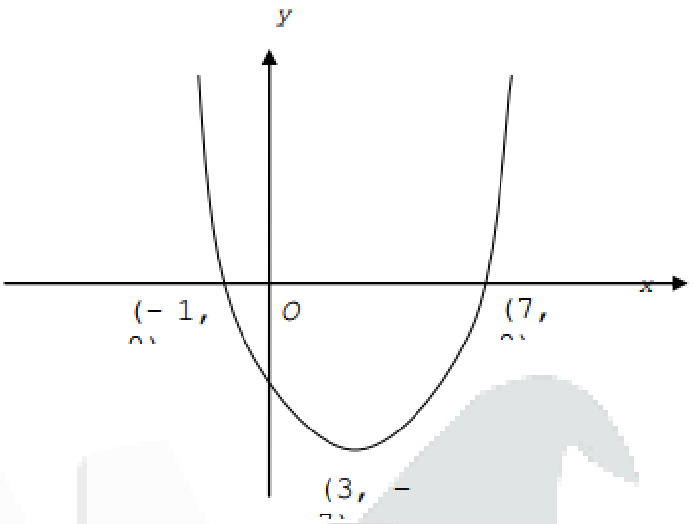


(i) Concave down curve with x-coordinate of maximum = 1 B1
Graph below x-axis and y-coordinate of maximum = −2 B1

(ii) No real roots (f.t. the number of times the candidate's curve cuts the x-axis) B1

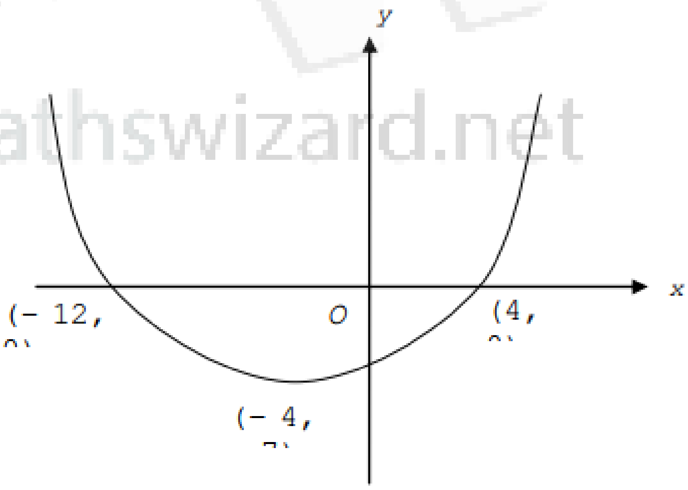
2012 Summer

9. (*a*)



Concave up curve and y-coordinate of minimum = – 7 B1
x-coordinate of minimum = 3 B1
Both points of intersection with x-axis B1

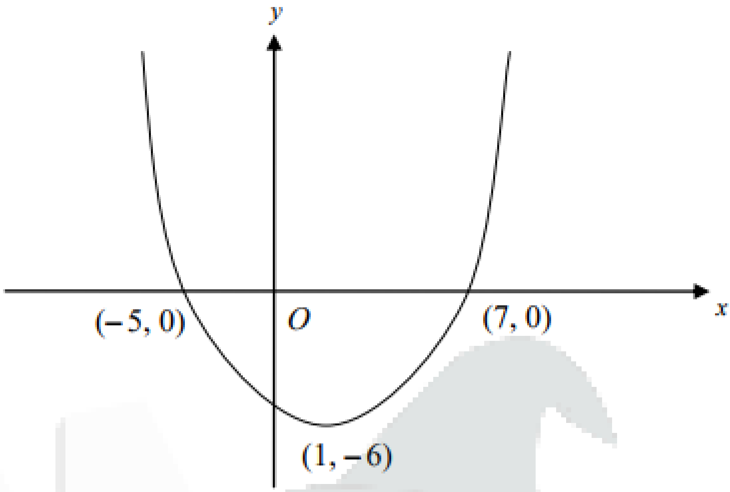
(*b*)



Concave up curve and y-coordinate of minimum = – 7 B1
x-coordinate of minimum = – 4 B1
Both points of intersection with x-axis B1

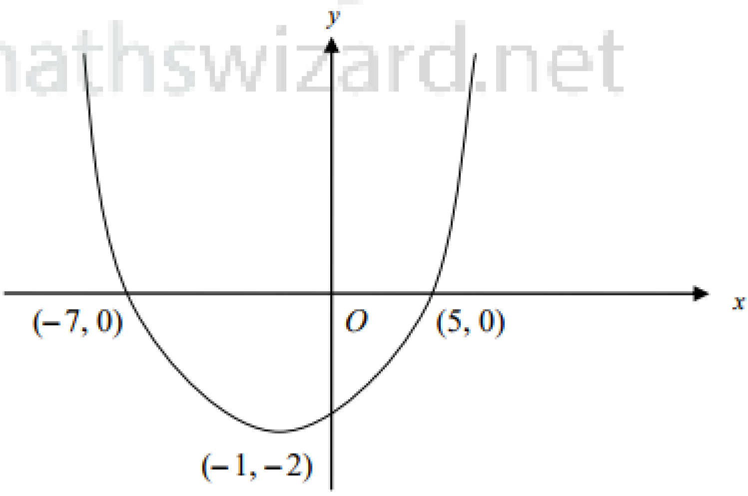
2013 Winter

9. (*a*)



Concave up curve and x-coordinate of minimum = 1	B1
y-coordinate of minimum = −6	B1
Both points of intersection with x-axis	B1

(*b*)

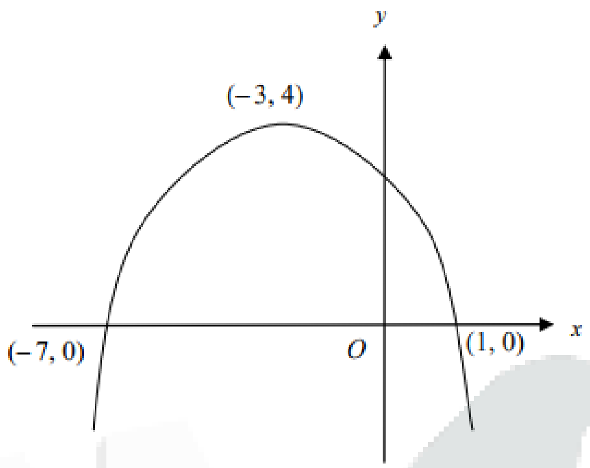


Concave up curve and y-coordinate of minimum = −2	B1
x-coordinate of minimum = −1	B1
Both points of intersection with x-axis	B1

Note: A candidate who draws a curve with no changes to the original graph is awarded 0 marks (both parts)

2013 Summer

9. (*a*)

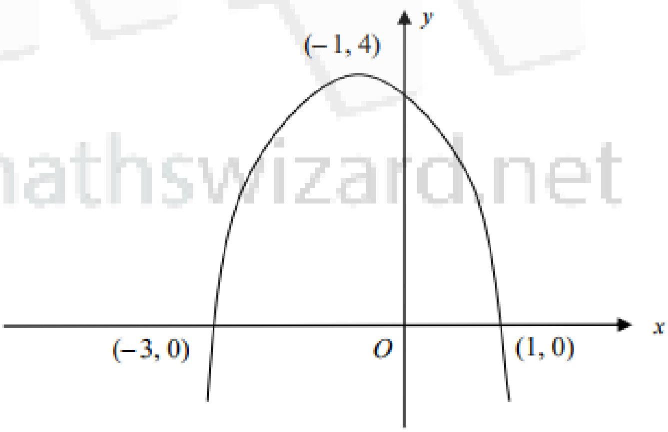


Concave down curve with y-coordinate of maximum = 4 B1

x-coordinate of maximum = – 3 B1

Both points of intersection with x-axis B1

(*b*)



Concave down curve with y-coordinate of maximum = 4 B1

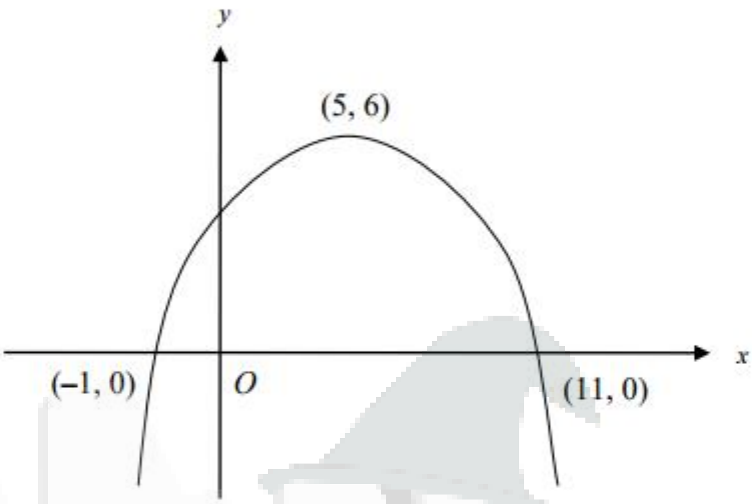
x-coordinate of maximum = – 1 B1

Both points of intersection with x-axis B1

Note: A candidate who draws a curve with no changes to the original graph is awarded 0 marks (both parts)

2014 Winter

7. (*a*)



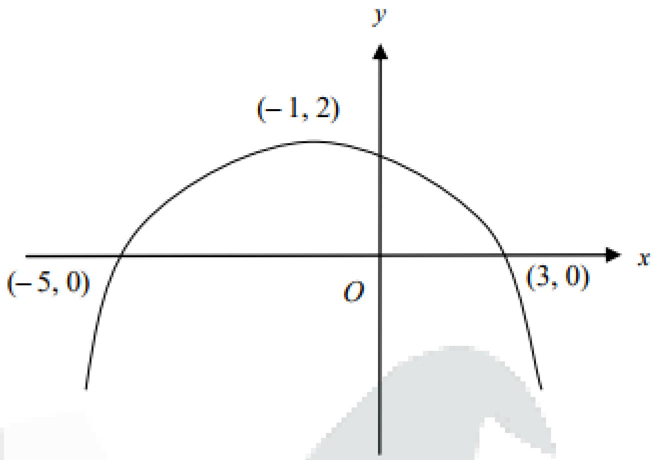
Concave down curve and y-coordinate of maximum = 6	B1
x-coordinate of maximum = 5	B1
Both points of intersection with x-axis	B1

(*b*) $y = f(-2x)$ B2

(If B2 not awarded, award B1 for either $y = f(-{}^1/_2 x)$ or $y = f(2x)$)

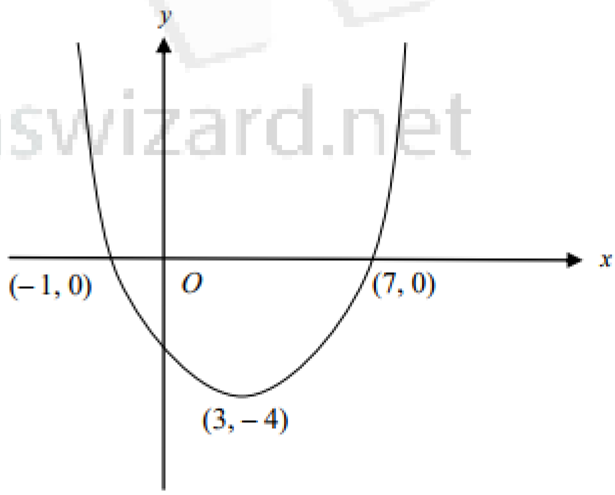
2014 Summer

9. (*a*) (i)



Concave down curve with y-coordinate of maximum = 2 B1
x-coordinate of maximum = – 1 B1
Both points of intersection with x-axis B1

(ii)

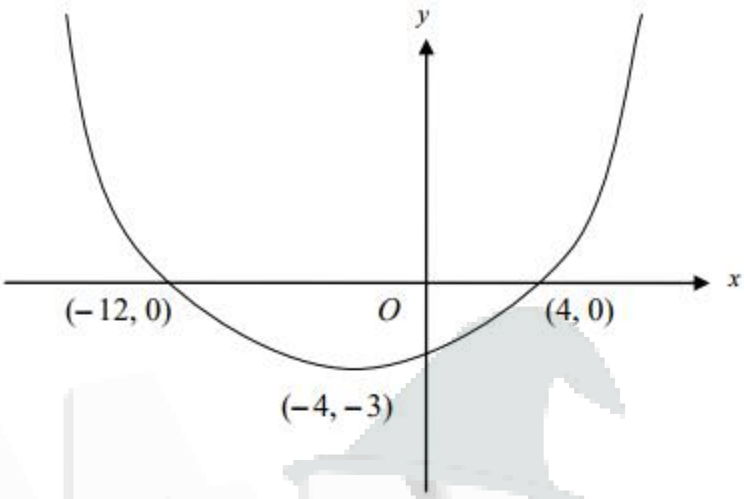


Concave up curve with x-coordinate of minimum = 3 B1
y-coordinate of minimum = – 4 B1
Both points of intersection with x-axis B1

(*b*) $x = 3$ (c.a.o.) B1

2015

9. (*a*)



Concave up curve and y-coordinate of minimum $= -3$	B1
x-coordinate of minimum $= -4$	B1
Both points of intersection with x-axis	B1

(*b*) **Either:**

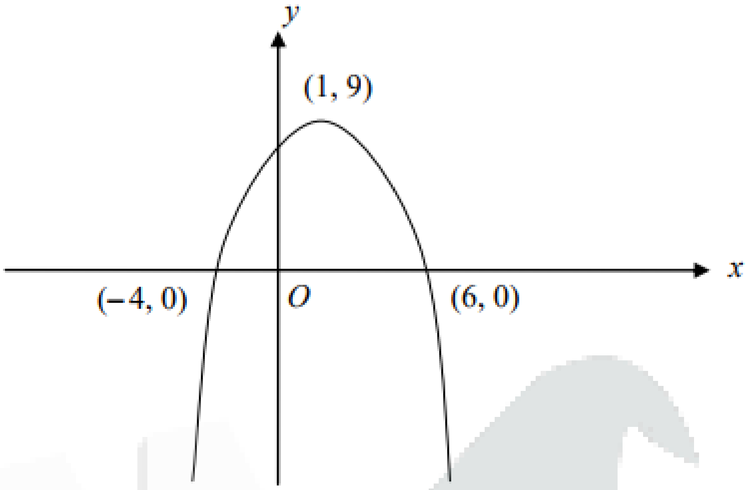
Any graph of the form $y = af(x)$ (with $a \neq 0$) will intersect the x-axis at $(-6, 0)$ and $(2, 0)$ and thus not pass through the origin.

Or:

$f(0) \neq 0$ and since $a \neq 0$, $af(0) \neq 0$. Thus any graph of the form $y = af(x)$ will not pass through the origin. E1

2016

7. (*a*)



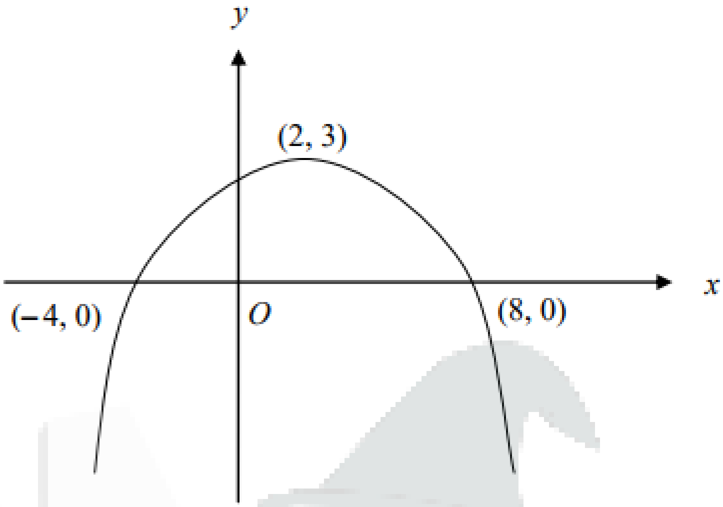
Concave down curve with x-coordinate of maximum = 1	B1
y-coordinate of maximum = 9	B1
Both points of intersection with x-axis	B1

(*b*)

$g(x) = f(-x)$	B1
$g(x) = f(x + 2)$	B1

2017

8. (*a*)



Concave down curve with maximum at $(2, a)$	B1
Maximum at $(2, 3)$	B1
Both points of intersection with x-axis	B1

(*b*)

The stationary point will always be a minimum	E1
The y-coordinate of the stationary point will always be -6	E1