Functions

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8 (a) $f(x) = 2^x$

Complete the table.

x	-2	-1 🔇	0	1	2	3	4
y = f(x)		0.5	1	2	4		

[3]

(b) g(x) = x(4 - x)

Complete the table.

x	-1	0	1	2	3	4
y = g(x)		0	3		3	0

[2]

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3

2) June 2010 V3

6 (a) Complete the table of values for $y = x + \frac{1}{x}$.



[2]



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(c) There are three integer values of k for which the equation $x + \frac{1}{x} = k$ has no solutions. Write down these three values of k.

Answer(c) k = 0 or k = 0 or k = 0 [2]

(d) Write down the ranges of x for which the gradient of the graph of $y = x + \frac{1}{x}$ is positive.

Answer(d) [2]

- (e) To solve the equation $x + \frac{1}{x} = 2x + 1$, a straight line can be drawn on the grid.
 - (i) Draw this line on the grid for $-2.5 \le x \le 1.5$.
 - (ii) On the grid, show how you would find the solutions.
 - (iii) Show how the equation $x + \frac{1}{x} = 2x + 1$ can be rearranged into the form $x^2 + bx + c = 0$ and find the values of b and c.

c = [3]

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[2]

[1]

3) Nove	embe	er 20)10	V1			
	8	(a)		$\mathbf{f}(x) = 2x - 1$	$g(x) = x^2$		
			Wo	rk out			
			(i)	f(2),		Anguar(a)(i)	[1]
			(ii)	$\sigma(-2)$		Answer(u)(1)	[1]
			(11)	8(-);		Answer(a)(ii)	[1]
			(iii)	ff(x) in its simplest for	rm,		
			6			Answer(a)(iii) ff(x) =	[2]
			(iv)	$f^{-1}(x)$, the inverse of f	(x),		
						Answer(a)(iv) $f^{-1}(x) =$	[2]
			(v)	x when $gf(x) = 4$.			
				Answ	ver(a)(v) x =	or <i>x</i> =	[4]
		(b)	y is	inversely proportional	to x and $y = 8$	when $x = 2$.	
			Fine	d,			
			(i)	an equation connecting	g y and x ,		
				WWW.	. 28'	Maths.com	
						Answer(b)(i)	[2]
			(ii)	y when $x = \frac{1}{2}$.			
						Answer(b)(ii) $y =$	[1]
					www.Q	8M aths.com	6

4) November 2010 V2

2

- g(x) = 4x 1
- (a) Find
 - (i) g(3),
 - (ii) f (-4).

Answer(a)(i)

 $f(x) = 6 + x^2$

- Answer(a)(ii) [1]
- (b) Find the inverse function $g^{-1}(x)$.

- Answer(b) $g^{-1}(x) =$ [2]
- (c) Find fg(x) in its simplest form.

Answer(c) fg(x) =[3]

(d) Solve the equation gg(x) = 3. www.Q8Maths.com

Answer(d) x =[3]

[1]

5) November 2010 V2 7 (a) Complete the table for the function $f(x) = \frac{2}{x} - x^2$.

x	-3	-2	-1	-0.5	-0.2	0.2	0.5	1	2	3
f(x)	-9.7	-5			-10.0	10.0	3.75	1		-8.3
										[3]

(b) On the grid draw the graph of y = f(x) for $-3 \le x \le -0.2$ and $0.2 \le x \le 3$.



- (c) Use your graph to
 - (i) solve f(x) = 2,

Answer(c)(i) x =[1]

(ii) find a value for k so that f(x) = k has 3 solutions.

Answer(c)(ii) k =[1]

(d) Draw a suitable line on the grid and use your graphs to solve the equation $\frac{2}{x} - x^2 = 5x$.

Answer(d) x = [3]

(e) Draw the tangent to the graph of y = f(x) at the point where x = -2.

Use it to calculate an estimate of the gradient of y = f(x) when x = -2.

Mull (Answer(e) [3]

6) November 2010 V3

7 (a) Complete the table for the function $f(x) = \frac{x^3}{10} + 1$.

x	-4	-3	-2	-1	0	1	2	3
f(x)		-1.7	0.2	0.9	1	1.1	1.8	

[2]

(b) On the grid, draw the graph of y = f(x) for $-4 \le x \le 3$.



(c) Complete the table for the function $g(x) = \frac{4}{x}, x \neq 0$.

x	-4	-3	-2	-1	1	2	3
g(<i>x</i>)	-1	-1.3				2	1.3
							[2

10

(d) On the grid, draw the graph of y = g(x) for $-4 \le x \le -1$ and $1 \le x \le 3$.

(e) (i) Use your graphs to solve the equation $\frac{x^3}{10} + 1 = \frac{4}{x}$.

Answer(e)(i) x = or x = [2]

(ii) The equation $\frac{x^3}{10} + 1 = \frac{4}{x}$ can be written as $x^4 + ax + b = 0$.

Find the values of *a* and *b*.

Answer(e)(ii) a = b = 0000[2]

[3]

7) June 2011 V1

7 (a) Complete the table of values for the equation $y = \frac{4}{x^2}$, $x \neq 0$.

x	-4	-3	-2	-1	-0.6	0.6	1	2	3	4
у	0.25	0.44			11.11		4.00		0.44	
			liter							[

(b) On the grid, draw the graph of $y = \frac{4}{x^2}$ for $-4 \le x \le -0.6$ and $0.6 \le x \le 4$.



[5]

(c) Use your graph to solve the equation $\frac{4}{r^2} = 6$.

$$r(c)x =$$
 [2]

(d) By drawing a suitable tangent, estimate the gradient of the graph where x = 1.5.

Answe

Answer(d) [3]

(e) (i) The equation $\frac{4}{x^2} - x + 2 = 0$ can be solved by finding the intersection of the graph of $x = \frac{4}{x^2}$ and a straight line

of $y = \frac{4}{x^2}$ and a straight line.

Write down the equation of this straight line.

Answer(e)(i) [1]

(ii) On the grid, draw the straight line from your answer to part (e)(i).

[2]

(iii) Use your graphs to solve the equation $\frac{4}{r^2} - x + 2 = 0$.

Answer(e)(iii) x =[1]

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8) June 2011 V2

4 (a) Complete the table of values for the function $y = x^2 - \frac{3}{x}$, $x \neq 0$.

x	-3	-2	-1	-0.5	-0.25	_	0.25	0.5	1	2	3
у	10	5.5		6.3	12.1	-	-11.9	3	X	2.5	8
					NWU						[3

(b) Draw the graph of
$$y = x^2 - \frac{3}{x}$$
 for $-3 \le x \le -0.25$ and $0.25 \le x \le 3$.



[5]

(c) Use your graph to solve $x^2 - \frac{3}{x} = 7$.

Answer(c) x = or x = [3]

(d) Draw the tangent to the curve where x = -2. Use the tangent to calculate an estimate of the gradient of the curve where x = -2.

Answer(d) [3]

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9) June 2011 V3

5

(a) Complete the table of values for the function f(x), where $f(x) = x^2 + \frac{1}{x^2}$, $x \neq 0$.

x	-3	-2.5	-2	-1.5	-1	-0.5		0.5	1	1.5	2	2.5	3	
f(<i>x</i>)		6.41		2.69		4.25		4.25		2.69		6.41		
			din				0			03				[3]

(b) On the grid, draw the graph of y = f(x) for $-3 \le x \le -0.5$ and $0.5 \le x \le 3$.



[]]

(c) (i) Write down the equation of the line of symmetry of the graph.

Answer(c)(i) [1]

(ii) Draw the tangent to the graph of y = f(x) where x = -1.5. Use the tangent to estimate the gradient of the graph of y = f(x) where x = -1.5.

Answer(c)(ii) [3]

(iii) Use your graph to solve the equation $x^2 + \frac{1}{x^2} = 3$.

Answer(c)(iii) x = or x = or x = [2]

(iv) Draw a suitable line on the grid and use your graphs to solve the equation $x^2 + \frac{1}{x^2} = 2x$.

 $Answer(c)(iv) x = \underbrace{com}_{or x = \dots} or x = \dots$ [3]

9



Show all your working and give your answers correct to 2 decimal places.

Answer(d) x = or x = [4]

11November 2011 V1

5 (a) Complete the table for the function $f(x) = \frac{x^3}{2} - 3x - 1$.

x	-3	-2	-1.5	-1	0	1	1.5	2	3	3.5	
f(x)	-5.5		1.8	1.5		-3.5	-3.8	-3		9.9	
				0.0	7						[3

(b) On the grid draw the graph of y = f(x) for $-3 \le x \le 3.5$.



20

- (c) Use your graph to
 - (i) solve f(x) = 0.5,

 $Answer(c)(i) x = \qquad \text{or } x = \qquad [3]$

(ii) find the inequalities for k, so that f(x) = k has only 1 answer.

Answer(c)(ii) k <

k> [2]

(d) (i) On the same grid, draw the graph of y = 3x - 2 for $-1 \le x \le 3.5$. [3]

(ii) The equation $\frac{x^3}{2} - 3x - 1 = 3x - 2$ can be written in the form $x^3 + ax + b = 0$. Find the values of *a* and *b*.

 $Answer(d)(ii) a = \qquad \text{and } b = \qquad [2]$

(iii) Use your graph to find the **positive** answers to $\frac{x^3}{2} - 3x - 1 = 3x - 2$ for $-3 \le x \le 3.5$.

Answer(d)(iii) x = or x = [2]



Answer(c)



Answer (d)(i)

(ii) Solve the equation $4x^2 - 3x - 2 = 0$.

Show all your working and give your answers correct to 2 decimal places.

Answer(d)(ii) x = or x =[4]

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[1]



(a) Complete the table for $f(x) = \frac{1}{x} + x^2$.

x	-3	-2	-1	-0.5	-0.3	-0.1
f(<i>x</i>)		3.5	0	-1.8	1	X

- (b) On the grid, draw the graph of y = f(x) for $-3 \le x < 0$.
- (c) By drawing a tangent, work out an estimate of the gradient of the graph where x = 2.

Answer(c) [3]

(d) Write down the inequality satisfied by k when f(x) = k has three answers.

Answer(d) [1]

(e) (i) Draw the line y = 1 - x on the grid for $-3 \le x \le 3$.

(ii) Use your graphs to solve the equation $1 - x = \frac{1}{x} + x^2$.

Answer(e)(ii) x =[1]

(f) (i) Rearrange $x^3 - x^2 - 2x + 1 = 0$ into the form $\frac{1}{x} + x^2 = ax + b$, where a and b are integers. Answer(f)(i)

[2]

[3]

[3]

[2]

(ii) Write down the equation of the line that could be drawn on the graph to solve $x^3 - x^2 - 2x + 1 = 0$.

$$Answer(f)(ii) y =$$
[1]

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25

2 (a) Complete the table of values for $y = 2^x$.

x	-2	-1	0	1	2	3
у	0.25		1	2		8

(b) On the grid, draw the graph of $y = 2^x$ for $-2 \le x \le 3$.



[2]

- (c) (i) On the grid, draw the straight line which passes through the points (0, 2) and (3, 8). [1]
 - (ii) The equation of this line is y = mx + 2.

Show that the value of *m* is 2.

Answer(c)(ii)

(iii) One answer to the equation $2^x = 2x + 2$ is x = 3.

Use your graph to find the other answer.

Answer(c)(iii) x =[1]

(d) Draw the tangent to the curve at the point where x = 1.

Use this tangent to calculate an estimate of the gradient of $y = 2^x$ when x = 1.

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Answer(d) [3]

[1]

15) Novem	per 2011 V3
8	$f(x) = x^2 + x - 1$ $g(x) = 1 - 2x$ $h(x) = 3^x$
	(a) Find the value of $hg(-2)$.
	<i>Answer(a)</i> [2]
	(b) Find $g^{-1}(x)$.
	$Answer(b) g^{-1}(x) = $ [2]
	(c) Solve the equation $f(x) = 0$. Show all your working and give your answers correct to 2 decimal places.
	Answer(c) x = or $x = $ [4]
	(d) Find fg(x).Give your answer in its simplest form.
	www.Q8Maths.com
	Answer(d) fg(x) = [3]
	(e) Solve the equation $h^{-1}(x) = 2$.
	Answer(e) x = [1]

16) June 2012 V1

3 The table shows some values for the equation $y = x^3 - 2x$ for $-2 \le x \le 2$.

x	-2	-1.5	-1	-0.6	-0.3	0	0.3	0.6	1	1.5	2
У	-4	-0.38			0.57		-0.57			0.38	4

- (a) Complete the table of values.
- (b) On the grid below, draw the graph of $y = x^3 2x$ for $-2 \le x \le 2$. The first two points have been plotted for you.



[3]

- (c) (i) On the grid, draw the line y = 0.8 for $2 \le x \le 2$.
 - (ii) Use your graph to solve the equation $x^3 2x = 0.8$.

 $Answer(c)(ii) x = \qquad \text{or } x = \qquad [3]$

(d) By drawing a suitable tangent, work out an estimate for the gradient of the graph of $y = x^3 - 2x$ where x = -1.5.

You must show your working.

Answer(d) [3]

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[1]

17) June 2012 V1

9			f(x) = 3x + 5	g(x) = 7	-2x	h(x) =	$=x^2-8$	
	(a) Fi	ind						
	(i) f(3),	,					
	(ii) g(x	-3) in terms of x	in its simplest fo	An: orm,	swer(a)(i)		[1]
	(iii) h(5 <i>x</i>	c) in terms of x in	its simplest form.	An:	<i>swer(a)</i> (ii)		[2]
	(b) Fi	ind the	inverse function	$q^{-1}(r)$	An	swer(a)(iii)		[1]
				g (4).	An	<i>swer(b)</i> g ⁻¹ (.	x) =	[2]
	(c) Fi	ind hf(<i>x</i>	c) in the form ax^2	+bx+c.	Answer(a	c) hf(x) =		[3]
	(d) So	olve the	e equation $ff(x) =$	83.	Mat		y /	[2]
					An	swer(u) x =	· ·	[ɔ]

(e) Solve the inequality 2f(x) < g(x).

Answer(e) [3]

18 June 2012 V3



(a) Complete the table.

x	0	0.5	1	1.5	2	2.5	3	3.5	4
f(<i>x</i>)		1.4	2	2.8	4	5.7	8		

[3]

(b) Draw the graph of y = f(x) for $0 \le x \le 4$.



(c) Use your graph to solve the equation $2^x = 5$.

Answer(c) x =[1]

(d) Draw a suitable straight line and use it to solve the equation $2^x = 3x$.

Answer(d) x = or x = [3]

(e) Draw a suitable tangent and use it to find the co-ordinates of the point on the graph of y = f(x) where the gradient of the graph is 3.

Answer(e) (, , , ,) [3]

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9 $f(r) = 1 - 2r$ $g(r) - \frac{1}{r} + r \neq 0$ $h(r) - r^3 + 1$	
g(x) = 1 - 2x $g(x) = -x + 0$ $f(x) = x + 1$	
(a) Find the value of	
(i) gf(2),	
(ii) h(-2).	2]
Answer(a)(ii) [1] (b) Find fg(x). Write your answer as a single fraction.	1]
(c) Find $h^{-1}(x)$, the inverse of $h(x)$.	2]
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$Answer(c) h^{-1}(x) = $	2]
www.Q8M aths.com 3-	4



(d) Write down which of these sketches shows the graph of each of y = f(x), y = g(x) and y = h(x).

20) November 2012 V1

2 (a) (i) Complete the table of values for $y = \frac{1}{2}x^3 + x^2 - 7x$.

x	-5	-4	-3	-2	-1	0	1	2	3	4
у	-2.5	12	16.5		7.5	0		-6	1.5	

[3]

(ii) On the grid, draw the graph of
$$y = \frac{1}{2}x^3 + x^2 - 7x$$
 for $-5 \le x \le 4$.



$$Answer(b) x = or x = or x = [3]$$
www.Q8M aths.com 36
(c) By drawing a suitable tangent, calculate an estimate of the gradient of the graph where x = -4.

Answer(c) [3]

(d) (i) On the grid draw the line y = 10 - 5x for $-2 \le x \le 3$.

(ii) Use your graphs to solve the equation $\frac{1}{2}x^3 + x^2 - 7x = 10 - 5x$.

Answer(d)(ii) x = [1]

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21) November 2012 V2



The graph of y = f(x) is drawn on the grid for $0 \le x \le 3.2$.

(c)
$$g(x) = \frac{x}{2} + \frac{2}{x^2} \quad x \neq 0$$

x	0.7	1 1.5	2	2.5	3
g(<i>x</i>)		1.6		1.6	1.7

(i) Complete the table for values of g(x), correct to 1 decimal place.

(ii) On the grid opposite, draw the graph of y = g(x) for $0.7 \le x \le 3$.

(iii) Solve f(x) = g(x) for $0.7 \le x \le 3$.

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[2]

22) November 2012 V3

4

$$f(x) = \frac{2}{x^2} - 3x, \ x \neq 0$$

(a) Complete the table.

x	-3	-2.5	-2	-1.5	-1	-0.5	0.5	1	1.5	2	2.5	3
f(<i>x</i>)	9.2	7.8	6.5	5.4		9.5	6.5		-3.6	-5.5	-7.2	-8.8

[2]

(b) On the grid, draw the graph of y = f(x), for $-3 \le x \le -0.5$ and $0.5 \le x \le 3$.



- (c) Use your graph to solve the equations.
 - (i) f(x) = 4

(ii) f(x) = 3x

- Answer(c)(i) x = [1]
- Answer(c)(ii) x =[2]
- (d) The equation f(x) = 3x can be written as $x^3 = k$.
 - Find the value of *k*.

Answer(d) k = [2]
(e) (i) Draw the straight line through the points (-1, 5) and (3, -9). [1]
(ii) Find the equation of this line.

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Answer(e)(ii) [3]

(iii) Complete the statement.

The straight line in **part (e)(ii)** is a _____ to the graph of y = f(x). [1]

23) June 2013 V1

2

f(x) =	$3 - x - x^2$	$g(x) = 3^x$
--------	---------------	--------------

(a) Complete the tables of values for f(x) and g(x).

x	-1.5	-1	-0.5	0	0.5	1	1.5
f(<i>x</i>)	2.25	3	3.25		2.25	1	-0.75
x	-1.5	-1	-0.5	0	0.5	1	1.5
g(<i>x</i>)	0.19	in the second seco	0.58		1.73	3	5.20

(b) On the grid, draw the graphs of y = f(x) and y = g(x) for $-1.5 \le x \le 1.5$.



- (c) For $-1.5 \le x \le 1.5$, use your graphs to solve
 - (i) f(x) = 0,

 $Answer(c)(i) x = \dots$ [1]

(ii) g(x) = 4,

 $Answer(c)(ii) x = \dots [1]$

(iii) f(x) = g(x).

- $Answer(c)(iii) x = \dots [1]$
- (d) By drawing a suitable tangent, find an estimate of the gradient of the graph of y = f(x) when x = 0.5.

Answer(d) [3]

24) June 2013 V1 9 $f(x) = x^2 + x - 3$ g(x) = 2x + 7 $h(x) = 2^x$ (a) Solve the equation f(x) = 0. Show all your working and give your answers correct to 2 decimal places. **(b)** $fg(x) = px^2 + qx + r$ Find the values of p, q and r. www.Q8Maths.com $Answer(b) p = \dots$ *q* = $r = \dots [3]$ www.Q8M aths.com **44**

(d) Find *x* when h(x) = 0.25.

 $Answer(d) x = \dots [1]$

(e) Find hhh(3).Give your answer in standard form, correct to 4 significant figures.

Answer(e) [4]

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25) June 2013 V2



3 The table shows some values for the function $y = 11x - 2x^2 - 12$ for $1 \le x \le 4.5$.

(a) Complete the table of values.

(b) On the grid below, draw the graph of $y = 11x - 2x^2 - 12$ for $1 \le x \le 4.5$.



[4]

- (c) By drawing a suitable line, use your graph to solve the equation $11x 2x^2 = 11$.
- (d) The line y = mx + 2 is a tangent to the curve $y = 11x 2x^2 12$ at the point *P*. By drawing this tangent, (i) find the co-ordinates of the point *P*,

Answer(d)(i) (.....) [2]

(ii) work out the value of m.

 $Answer(d)(ii) m = \dots [2]$

26) June 2013 V3

x	-3	-2	-1	-0.5	-0.2	0.2	0.5	1	2	3
f(<i>x</i>)	-9.33	-4.5	-2	-2.25		4.96			-3.5	-8.67
		allow			der 12					

5 (a) Complete this table of values for the function $f(x) = \frac{1}{x} - x^2$, $x \neq 0$.

(b) Draw the graph of $f(x) = \frac{1}{x} - x^2$ for $-3 \le x \le -0.2$ and $0.2 \le x \le 3$.



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(c) Use your graph to solve f(x) = -3.

Answer(c) x = or x = [3]

(d) By drawing a suitable line on your graph, solve the equation f(x) = 2x - 2.

Answer(d) x = or x = [3]

(e) By drawing a suitable tangent, work out an estimate of the gradient of the curve at the point where x = -2.

You must show your working.

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(h)
$$g(x) = 1 - 2x$$
 $h(x) = x^{2} - 1$
(i) Find gb(3).
(i) Find g⁻¹(x).
(ii) Find g⁻¹(x).
(iii) Solve the equation $h(x) = 3$.
(iv) Solve the equation $h(x) = 3$.
(iv) Solve the equation $g(3x) = 2x$.

28) November 2013 V1

(a) Complete the table of values for $y = \frac{2}{x^2} - \frac{1}{x} - 3x$. 5

x	-3	-2	-1	-0.5	-0.3	0.3	0.5	1	2	3
у	9.6		6		26.5	18.0		-2	-6	-9.1

[3]

(**b**) Draw the graph of $y = \frac{2}{x^2} - \frac{1}{x} - 3x$ for $-3 \le x \le -0.3$ and $0.3 \le x \le 3$.



- (c) Use your graph to solve these equations.
 - (i) $\frac{2}{x^2} \frac{1}{x} 3x = 0$

- (ii) $\frac{2}{x^2} \frac{1}{x} 3x 7.5 = 0$
- Answer(c)(ii) x = or x = [3]

(d) (i) By drawing a suitable straight line on the graph, solve the equation $\frac{2}{x^2} - \frac{1}{x} - 3x = 10 - 3x$.

(ii) The equation $\frac{2}{x^2} - \frac{1}{x} - 3x = 10 - 3x$ can be written in the form $ax^2 + bx + c = 0$ where *a*, *b* and *c* are integers.

Find the values of *a*, *b* and *c*.

Answer(d)(ii) $a = \dots, b = \dots, c = \dots$ [3]

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(c) (i) Solve the equation f(x) = 23.

 $Answer(c)(i) \quad x = \dots$ [2]

(ii) Solve the equation h(x) = 7.

Show all your working and give your answers correct to 2 decimal places.

30) June 2014 V1

8 (a) Complete the table of values for $y = x^3 - 3x + 1$.

x	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5
у	-7.125	-1		3		1	-0.375	-1	-0.125	3	9.125

[2]

(**b**) Draw the graph of $y = x^3 - 3x + 1$ for $-2.5 \le x \le 2.5$.



(c) By drawing a suitable tangent, estimate the gradient of the curve at the point where x = 2.

(d) Use your graph to solve the equation $x^3 - 3x + 1 = 1$.

Answer(d) x = or x = [2]

(e) Use your graph to complete the inequality in k for which the equation

 $x^3 - 3x + 1 = k$ has three different solutions.

Answer(*c*)[3]

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(v)	Show that the equation $f(x) = g(x)$ simplifies to $2x^2 - 3x - 6 = 0$.	
	Answer(a)(v)	
		[3]
(vi)	Solve the equation $2x^2 - 3x - 6 = 0$.	
	Give your answers correct to 2 decimal places. Show all your working.	
	Answer(a)(vi) $x =$ or $x =$	
(b) Sin	nplify $\frac{x^2 - 3x + 2}{x^2 + 3x - 10}$.	
	x + 5x = 10	
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	Answer(b)	[4]
	www.Q8M aths.com	59

32) June 2014 V2

10	(a)	$f(x) = \frac{1}{x}, x \neq 0$ $g(x) = 1 - x$ $h(x) = x^2 + 1$ Find $fg(\frac{1}{2})$.	
	(b)	Find $g^{-1}(x)$, the inverse of $g(x)$.	[2]
	(c)	Answer(b) $g^{-1}(x) = \dots$ Find hg(x), giving your answer in its simplest form.	[1]
	(d)	Find the value of x when $g(x) = 7$.	[3]
	(e)	Answer(d) $x =$ Solve the equation $h(x) = 3x$. Show your working and give your answers correct to 2 decimal places.	[1]
		www.Q8 Maths.com	
		Answer(e) $x = \dots$ or $x = \dots$	[4]
	(f)	A function $k(x)$ is its own inverse when $k^{-1}(x) = k(x)$.	
		For which of the functions $f(x)$, $g(x)$ and $h(x)$ is this true?	
		Answer(f)	[1]

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33) June 2014 V3

4 The table shows some values for the function $y = \frac{1}{x^2} + x$, $x \neq 0$.

x	-3	-2	-1	-0.5	0.5	1	2	3	4
у	-2.89	-1.75		3.5		2	2.25		4.06

- (a) Complete the table of values.
- (**b**) On the grid, draw the graph of $y = \frac{1}{x^2} + x$ for $-3 \le x \le -0.5$ and $0.5 \le x \le 4$.



[5]

- (c) Use your graph to solve the equation $\frac{1}{x^2} + x 3 = 0$.
 - Answer(c) x = or x = [3]

(d) Use your graph to solve the equation $\frac{1}{x^2} + x = 1 - x$.

 $Answer(d) x = \dots [3]$

(e) By drawing a suitable tangent, find an estimate of the gradient of the curve at the point where x = 2.

(f) Using algebra, show that you can use the graph at y = 0 to find $\sqrt[3]{-1}$.

Answer(f)

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34)

) June	e 201	<u>14 V3</u>		
9		$\mathbf{f}(x) = 4 - 3x \qquad \qquad \mathbf{g}(x) = 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5$	$(x) = 3^{-x}$	
	(a)	Find $f(2x)$ in terms of x .		
			Answar(a) f(2r) -	[1]
	(b)	Find $ff(x)$ in its simplest for	m.	[1]
			Answer(b) $ff(x) =$	[2]
	(c)	Work out $gg(-1)$.		
		Give your answer as a fract		
			Answer(c)	[3]
	(d)	Find $f^{-1}(x)$, the inverse of f	(x).	[9]
			Answer(d) $f^{-1}(x) = \dots$	[2]
	(e)	Solve the equation $gf(x) =$	r. Lo' Maths.com	

35) November 2014 V1



(c) Use your graph to solve the equation $x^2 + \frac{3}{x} = 5$.

Answer(c) x = or x = [3]

(d) By drawing a suitable straight line, solve the equation $x^2 + \frac{3}{x} = x + 5$.

Answer(d) x = or x = [4]

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(c) Solve h(x) = 11, showing all your working and giving your answers correct to 2 decimal places.

(d) Find $f^{-1}(x)$.

(e) Solve $g^{-1}(x) = -0.5$.

 $Answer(e) x = \dots [1]$ WWW. Q8 Maths.com



- (c) Use your graph to find an **integer** value of k so that f(x) = k has
 - (i) exactly one solution,

 $Answer(c)(i) k = \dots$ [1]

(ii) three solutions.

 $Answer(c)(ii) k = \dots [1]$

(d) By drawing a suitable straight line on the graph, solve the equation f(x) = 15x + 2 for $-1.5 \le x \le 2$.

Answer(*d*) x = [4]

(e) Draw a tangent to the graph of y = f(x) at the point where x = 1.5.

Use your tangent to estimate the gradient of y = f(x) when x = 1.5.

38) November 2014 V3

- 8 (a) A straight line joins the points (-1, -4) and (3, 8).
 - (i) Find the midpoint of this line.





(c) Sketch the graph of $y = 18 + 7x - x^2$ on the axes below.

39) June 2015 V1

2 The table shows some values for $y = x^2 - \frac{1}{2x}, x \neq 0$.

x	-2	-1.5	-1	-0.5	-0.25	-0.2	0.2	0.25	0.5	1	1.5	2
у	4.25	2.58			2.06	2.54	-2.46	-1.94			1.92	3.75

(a) Complete the table of values.

(b) On the grid, draw the graph of $y = x^2 - \frac{1}{2x}$ for $-2 \le x \le -0.2$ and $0.2 \le x \le 2$.



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[4]
(d) The equation $x^2 - \frac{1}{2x} = k$ has only one solution.

Write down the range of values of k for which this is possible.

(e) By drawing a suitable tangent, find an estimate of the gradient of the curve at the point where x = -1.

Answer(e) [3]

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40) June 2015 V2

5 $y = x^2 - 2x + \frac{12}{x}, x \neq 0$

(a) Complete the table of values.

x	-4	-3	-2	-1	-0.5	0.5	1	2	3	4	
У	21	11		-9	-22.75	23.25	11	6		11	
											[2]





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[5] **74**

- (c) By drawing a suitable tangent, find an estimate of the gradient of the graph at the point (1, 11).
 - Answer(c) [3]

(d) The equation $x^2 - 2x + \frac{12}{x} = k$ has exactly two distinct solutions.

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Use the graph to find

(i) the value of k,

 $Answer(d)(i) k = \dots [1]$

- (ii) the solutions of $x^2 2x + \frac{12}{x} = k$.
- (e) The equation $x^3 + ax^2 + bx + c = 0$ can be solved by drawing the line y = 3x + 1 on the grid. Find the value of a, the value of b and the value of c.

$Answer(e) a = \dots$	
Maths.6=0.111	
<i>c</i> =	[3]

41) June 2015 V3

3

$$f(x) = \frac{8}{x^2} + \frac{x}{2}, \quad x \neq 0.$$

(a) Complete the table of values for f(*x*).

x	-5	-4	-3	-2	-1.5	1.5	2	2.5	3	3.5	4	5
f(<i>x</i>)	-2.2	-1.5	-0.6		2.8	4.3		2.5	2.4	2.4		2.8

(b) On the grid, draw the graph of y = f(x) for $-5 \le x \le -1.5$ and $1.5 \le x \le 5$.



[5]

(c) Solve f(x) = 0.

 $Answer(c) x = \dots [1]$

(d) By drawing a suitable line on the grid, solve the equation f(x) = 1 - x.

 $Answer(d) x = \dots [3]$

(e) By drawing a tangent at the point (-3, -0.6), estimate the gradient of the graph of y = f(x) when x = -3.

Answer(e) [3]

42) June 2015 V3

- 10 f(x) = 2x 1 $g(x) = x^2 + x$ $h(x) = \frac{2}{x}, x \neq 0$
 - (a) Find ff(3).
 - (b) Find gf(x), giving your answer in its simplest form.

(c) Find $f^{-1}(x)$.

Answer(a) [2]

(d) Find h(x) + h(x + 2), giving your answer as a single fraction.

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43) November 2015 V1	
2 (a) Calculate $2^{0.7}$.	
	Answer(a)[1]
(b) Find the value of x in each of the following.	
(i) $2^x = 128$	
	$Answer(b)(i) x = \dots [1]$
(ii) $2^x \times 2^9 = 2^{13}$	
	$Answer(b)(ii) x = \dots [1]$
(iii) $2^9 \div 2^x = 4$	
	Answer(b)(iii) x =[1]
(iv) $2^x = \sqrt[3]{2}$	
	$Answer(b)(iv) x = \dots [1]$
(c) (i) Complete this table of values for $y = 2^x$.	
x 3 2 1	
<i>y</i> 0.123 0.3	
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44) November 2015 V2

2 The table shows some values for $y = x^3 - 3x + 2$.

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y		3.125		3.375	2		0		4

(a) Complete the table of values.

(b) On the grid, draw the graph of $y = x^3 - 3x + 2$ for $-2 \le x \le 2$.



[4]

4

$$f(x) = x - \frac{1}{2x^2}, x \neq 0$$

(a) Complete the table of values.

x	-3	-2	-1.5	-1	-0.5	-0.3	0.3	0.5	1	1.5	2
f(x)	-3.1	-2.1	-1.7		-2.5	-5.9	-5.3	-1.5		1.3	1.9

(b) On the grid, draw the graph of y = f(x) for $-3 \le x \le -0.3$ and $0.3 \le x \le 2$.



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[2]

- (d) There is only one negative integer value, k, for which f(x) = k has only one solution for all real x.Write down this value of k.
 - Answer(d) $k = \dots$ [1]
- (e) The equation $2x \frac{1}{2x^2} 2 = 0$ can be solved using the graph of y = f(x) and a straight line graph. (i) Find the equation of this straight line.

- $Answer(e)(i) y = \dots [1]$
- (ii) On the grid, draw this straight line and solve the equation $2x \frac{1}{2x^2} 2 = 0$.

Answer(e)(ii) x =[3]

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46) Nov	vember 2015 V3		
9	$\mathbf{f}(x) = 2x - 1$	$g(x) = \frac{1}{x}, x \neq 0$ $h(x) = 2^{x}$	
	(a) Find h(3).		r11
	(b) Find fg(0.5).	Answer(a)	
		Answer(b)	[2]
	(c) Find $f^{-1}(x)$.		
		<i>Answer(c)</i> $f^{-1}(x) = \dots$	[2]
	(d) Find ff(<i>x</i>), giving you	r answer in its simplest form.	
		Mattre com	
		<i>Answer(d)</i>	[2]
		www.Q8M aths.com	84

(e) Find $(f(x))^2 + 6$, giving your answer in its simplest form.

Answer(f)[1]

(f) Simplify $hh^{-1}(x)$.

(g) Which of the following statements is true?

 $f^{-1}(x) = f(x)$ $g^{-1}(x) = g(x)$ $h^{-1}(x) = h(x)$

Answer(g) [1]

(h) Use two of the functions f(x), g(x) and h(x) to find the composite function which is equal to $2^{x+1} - 1$.

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47) March 2015 V2

3 The table shows some values of $y = x^3 + 3x^2 - 2$.

x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1
у	-2	1.13		1.38		-1.38		-1.13	

(a) Complete the table of values.

(b) On the grid, draw the graph of $y = x^3 + 3x^2 - 2$ for $-3 \le x \le 1$.



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48) March 2016 V2

7 The table shows some values of $y = x + \frac{1}{x^2}$, $x \neq 0$.

x	-2	-1.5	-1	-0.75	-0.5	0.5	0.75	1	1.5	2	3
У	-1.75	-1.06	0	1.03		4.50	2.53	2		2.25	

- (a) Complete the table of values.
- (b) On the grid, draw the graph of $y = x + \frac{1}{x^2}$ for $-2 \le x \le -0.5$ and $0.5 \le x \le 3$.



(c) Use your graph to solve the equation $x + \frac{1}{x^2} = 1.5$.

(d) The line y = ax + b can be drawn on the grid to solve the equation $\frac{1}{x^2} = 2.5 - 2x$.

(i) Find the value of a and the value of b.

(ii) Draw the line y = ax + b to solve the equation $\frac{1}{x^2} = 2.5 - 2x$.

a =

(e) By drawing a suitable tangent, find an estimate of the gradient of the curve at the point where x = 2.

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49) March 2016 V2

11

f(x) = 2 - 3x g(x) = 7x + 3

- (a) Find
 - (i) f(-3),
 - (ii) g(2x).
- (b) Find gf(x) in its simplest form.

(c) Find x when 3f(x) = 7.

- (d) Solve the equation.
 - f(x+4) g(x) = 0 WWW. Q8 Maths.com

x =

[1]

. [2]



(c)	Using your graph, solve the equation $f(x) = 11$.
	$x = \dots $ or $x = \dots $ [2]
(d)	k is a prime number and $f(x) = k$ has no solutions.
	Find the possible values of <i>k</i> .
	[2]
(e)	The gradient of the graph of $y = f(x)$ at the point (2, 12) is -4.
	Write down the co-ordinates of the other point on the graph of $y = f(x)$ where the gradient is -4.
	(
(f)	(i) The equation $f(x) = x^2$ can be written as $x^3 + px^2 + q = 0$.
	Show that $p = -1$ and $q = -20$.
	[2]
	(ii) On the grid opposite, draw the graph of $y = x^2$ for $-4 \le x \le 4$. [2]
	(iii) Using your graphs, solve the equation $x^3 - x^2 - 20 = 0$.
	$x = \dots [1]$
	(iv)
	y y
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	,
	The diagram shows a sketch of the graph of $y = x^3 - x^2 - 20$. <i>P</i> is the point (<i>n</i> , 0).
	Write down the value of <i>n</i> .
	$n = \dots $
	www.Q8M aths.com 91

51) June 201	<u>6 V1</u>			
8	$\mathbf{f}(x) = 2x + 1$	$g(x) = x^2 + 4$	$\mathbf{h}(x) = 2^x$	
(a)	Solve the equation $f(x) = g(1)$.			
			<i>x</i> =	[2]
(b)	Find the value of fh(3).			
				[2]
(c)	Find $f^{-1}(x)$.			[2]
	Find $af(x)$ in its simplest form	f	$f(x) = \dots$	[2]
(u)	That gr(x) in its simplest form.			
		Mathe	2- C GANA	
		11 (1113		
				[3]
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52) June 2016 V2

4

$$f(x) = x^2 - \frac{1}{x} - 4$$
, $x \neq 0$

(a) (i) Complete the table.

x	-3	-2	-1	-0.5	-0.1	0.2	0.5	1	2	3
f(<i>x</i>)	5.3	0.5		-1.8	6.0	-9.0	-5.8	-4		4.7

On the grid, draw the graph of y = f(x) for $-3 \le x \le -0.1$ and $0.2 \le x \le 3$. (ii)



[2]

- (b) Use your graph to solve the equation f(x) = 0.
- $x = \dots$ or $x = \dots$ [3]
- (c) Find an integer k, for which f(x) = k has one solution.
- (d) (i) By drawing a suitable straight line, solve the equation f(x) + 2 = -5x.

 - (ii) f(x) + 2 = -5x can be written as $x^3 + ax^2 + bx 1 = 0$.

Find the value of a and the value of b.





- (a) (i) Find f(-2).
 - (ii) Solve the equation f(x) = 2.
 - (iii) Two tangents, each with gradient 0, can be drawn to the graph of y = f(x).

Write down the equation of each tangent.

.....[2]

.....[1]

 $x = \dots$ or $x = \dots$ [3]

(b) (i) Complete the table for $g(x) = \frac{2}{x} + 3$ for $-3.5 \le x \le -0.5$ and $0.5 \le x \le 2.5$.

g(x) 2.4 2.3 1 7 5 3.8	x	-3.5	-3	-2	-1	-0.5		0.5	1	_2	2.5
	g(x)	2.4	2.3		1		5	7	5		3.8

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(ii) On the grid opposite, draw the graph of y = g(x).

- (iii) Use your graph to solve the equation f(x) = g(x).
- (c) Find gf(-2).

(d) Find $g^{-1}(5)$.

.....[1]

 $x = \dots$ [2]

[4]

(b) f(x) = g(x)

(i) Show that $5x^2 - 8x - 25 = 0$.

(ii) Solve $5x^2 - 8x - 25 = 0$. Show all your working and give your answers correct to 2 decimal places.

www. Q8 Maths. $x = \dots$ [4]

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(a) Find f(1).

.....[1]

- **(b)** Solve f(x) = 3.
- (c) The equation f(x) = k has only one solution for $-2.5 \le x \le 2$.

Write down the range of values of k for which this is possible.

......[2]

(d) By drawing a suitable straight line, solve the equation f(x) = x - 5.

 $x = \dots$ or $x = \dots$ [3]

(e) Draw a tangent to the graph of y = f(x) at the point where x = 1.

Use your tangent to estimate the gradient of y = f(x) when x = 1.

.....[3]

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56) November 2017 V1

- 4
- $f(x) = x^3 4x^2 + 15$

(a) Complete the table of values for y = f(x).

x	-2	-1	-0.5	0	1	2	2.5	3	3.5	4	4.5
у	-9		13.9	15	12		5.6	6	8.9	15	25.1

(b) On the grid, draw the graph of y = f(x) for $-2 \le x \le 4.5$.



[4]

[2]

(c) Use your graph to solve the equation f(x) = 0. (d) By drawing a suitable tangent, estimate the gradient of the graph of y = f(x) when x = 3.5.[3] (e) By drawing a suitable straight line on the grid, solve the equation $x^3 - 4x^2 - 2x + 5 = 0$. $x = \dots$ or $x = \dots$ [4] www.Q8Maths.com



			1	1				
(a)	Write down the e	equation of the l	ine of symme	try of the	graph.			
(b)	On the grid oppo Find the gradient	site, draw the ta of this tangent.	angent to the o	curve at th	ne point wl	here $x = 1$	0.5 .	[1]
								[3]
(c)	The table shows	some values for	$y = x^3 + 3x$;+4.				
	x	-1.5 -	1 -0.5	0	0.5	1	1.5	
	у	-3.9		R	5.6	8	11.9	
	(i) Complete th	ie table.						[3]
	(ii) On the grid	opposite, draw	the graph of	$y = x^3 +$	-3x+4 for	or -1.5	$\leq x \leq 1.5$.	[4]
(d)	Show that the value equation $x^3 + 8x^3$	lues of x where $x^2 + 3x - 6 = 0.$	the two curve	es intersec	et are the se	olutions t	o the	
								[1]
(e)	By drawing a sui	table straight lin	ne, solve the e	equation	$x^3 + 5x + 3$	2 = 0 for	or $-1.5 \leq x \leq$	≤ 1.5 .
		uuu.	281	Ma	ths.c	0111 =		[3]

58) June 2018 V2



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(c) (i) By drawing a suitable tangent, find an estimate of the gradient of the curve at x = -2.[3] (ii) Write down the equation of the tangent to the curve at x = -2. Give your answer in the form y = mx + c.[2] v =(d) Use your graph to solve the equations. (i) $\frac{x^3}{3} - \frac{1}{2x^2} = 0$ (ii) $\frac{x^3}{3} - \frac{1}{2x^2} + 4 = 0$ $x = \dots$ or $x = \dots$ [3] (e) The equation $\frac{x^3}{3} - \frac{1}{2x^2} + 4 = 0$ can be written in the form $ax^n + bx^{n-3} - 3 = 0$. Find the value of *a*, the value of *b* and the value of *n*. *a* = uuu. Q8 Maths.gem $n = \dots [3]$

<u>59) June 2019 V2</u>

5 The table shows some values of $y = \frac{1}{2x} - \frac{x}{4}$ for $0.15 \le x \le 3.5$.

x	0.15	0.2	0.5	1	1.5	2	2.5	3	3.5
У	3.30		0.88		-0.04		-0.43	-0.58	-0.73

- (a) Complete the table.
- (b) On the grid, draw the graph of $y = \frac{1}{2x} \frac{x}{4}$ for $0.15 \le x \le 3.5$.

The last two points have been plotted for you.


(c) Use your graph to solve the equation $\frac{1}{2x} - \frac{x}{4} = \frac{1}{2}$ for $0.15 \le x \le 3.5$.

- (d) (i) On the grid, draw the line y = 2-x.
 - (ii) Write down the x co-ordinates of the points where the line y = 2 x crosses the graph of
 - $y = \frac{1}{2x} \frac{x}{4}$ for $0.15 \le x \le 3.5$.

- $x = \dots$ and $x = \dots$ [2]
- (e) Show that the graph of $y = \frac{1}{2x} \frac{x}{4}$ can be used to find the value of $\sqrt{2}$ for $0.15 \le x \le 3.5$.

[2]

[2]

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60) June 2020 V2											
6		f(x) = 3x + 2	$g(x) = x^2 + 1$	$h(x) = 4^x$							
	(a)	Find h(4).									
	()										
				[1]							
	(b)	Find fg(1).									
	(c)	Find $gf(x)$ in the fo	$\operatorname{rm} ax^2 + bx + c.$								
				[3]							
	(d)	Find x when $f(x)$	= g(7).								
				$x = \dots $ [2]							
	(e)	Find $f^{-1}(x)$.	$\bigcap \mathcal{O}$	Dad H							
		l	www.Lo	Maths.com							
				1							
				$f^{-1}(x) = \dots [2]$							

(f) Find $\frac{g(x)}{f(x)} + x$.

Give your answer as a single fraction, in terms of x, in its simplest form.



9) June 2020 V3

10 (a) The diagrams show the graphs of two functions.

Write down each function.





The diagram shows the graph of another function.

By drawing a suitable tangent, find an estimate for the gradient of the function at the point *P*.

......[3]

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(iii) By drawing a suitable straight line on the grid, solve f(x) = 2x - 2 for $-3 \le x \le 3$.



The diagram shows a curve with equation $y = 2x^2 - 2x - 7$. The straight line with equation y = 3x + 5 intersects the curve at the points A and B.

Find the coordinates of the points A and B.

A (.....) *B*(.....) [5]

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62) Nevember 2020 1/2											
10		$f(x) = x^2 + 1$	g(x) = 1 - 2x	$h(x) = \frac{1}{x}, \ x \neq 0$	0	$j(x) = 5^x$					
	(a)	Find the value of									
		(i) f(3),									
								[1]			
								[1]			
		(ii) gf(3).									
					.			[1]			
	(b)	Find $g^{-1}(x)$.									
				1 (() -			[2]			
				g ($(x) = \dots$			[2]			
	(c)	Find x when $h(x) =$	= 2.								
					<i>x</i> =			[1]			
					2 -			[-]			
	(d)	Find $g(x)g(x) - gg(x)$	(x), giving your answ	er in the form ax^2	$^2 + bx + c$	С.					
			\square	MAL H							
		l	www.LO	' Math	8.00	M					
								[4]			

