25 $f(x) = x^3 + 1$

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

$f^{-1}(x) =$ ..... [2]

25	$\sqrt[3]{x-1}$ or $(x-1)^{\frac{1}{3}}$	**2**	**M1** for $x=y^3+1$ or for $y-1=x^3$ or better

11 $f(x) = 2x - 1$ $g(x) = 3x + 2$ $h(x) = \frac{1}{x}, x \neq 0$ $j(x) = x^2$

(a) Find $j(-1)$.

..... [1]

(b) Find x when $f(x) + g(x) = 0$.

$x =$ ..... [2]

(c) Find $gg(x)$, giving your answer in its simplest form.

..... [2]

(d) Find $\mathrm{hf}(x) + \mathrm{gh}(x)$, giving your answer as a single fraction in its simplest form.

..... [4]

(e) When $\mathrm{pp}(x) = x$, $\mathrm{p}(x)$ is a function such that $\mathrm{p}^{-1}(x) = \mathrm{p}(x)$.

Draw a ring around the function that has this property.

$\mathrm{f}(x) = 2x - 1$ $\mathrm{g}(x) = 3x + 2$ $\mathrm{h}(x) = \frac{1}{x}, x \neq 0$ $\mathrm{j}(x) = x^2$

[1]

11(a)	1	**1**	
11(b)	$-\frac{1}{5}$ or -0.2	**2**	**M1** for $2x-1+3x+2=0$ oe isw
11(c)	$9x+8$ final answer	**2**	**M1** for $3(3x+2)+2$
11(d)	$\frac{4x^2+5x-3}{x(2x-1)}$ final answer	**4**	**M1** for $\frac{1}{2x-1}$ and $3\left(\frac{1}{x}\right)+2$ oe **B1** for $x+3(2x-1)+2x(2x-1)$ oe or better isw **B1** for common denominator $=x(2x-1)$ isw If 0 scored, **SC1** for answer $\frac{4x^2+9x+3}{x(2x+1)}$
11(e)	h(x) indicated	**1**	

14 $f(x) = 5x + 2$

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

$f^{-1}(x) =$ ..... [2]

14	$\frac{x-2}{5}$ oe final answer	**2**	**M1** for a correct first step $x=5y+2$ or $y-2=5x$ or $\frac{y}{5}=x+\frac{2}{5}$

20 $f(x) = 6x - 7$ $g(x) = x^{-3}$

(a) Find $f(x+2)$.
Give your answer in its simplest form.

..... [2]

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

$f^{-1}(x) =$ ..... [2]

(c) Find x when $g(x) = f(22)$.

$x =$ ..... [2]

20(a)	$6x+5$ cao final answer	**2**	**M1** for $6(x+2)-7$ oe
20(b)	$\frac{x+7}{6}$ or $\frac{x}{6}+\frac{7}{6}$ final answer	**2**	**M1** for $x=6y-7$ or $y+7=6x$ or $\frac{y}{6}=x-\frac{7}{6}$
20(c)	$\frac{1}{5}$ or 0.2	**2**	**M1** for $x^{-3}=6\times22-7$ or better

10 $f(x) = x - 4$ $g(x) = 2x + 5$ $h(x) = 3^x$

(a) Find

(i) $f(-3)$

..... [1]

(ii) $g^{-1}(x)$

$g^{-1}(x) =$ ..... [2]

(iii) $f(x) \times g(x) \times f(x)$.

..... **[4]**

(b) Find x when $h(x) = g(f(2))$.

$x =$ ..... [2]

10(a)(i)	-7	**1**	
10(a)(ii)	$\frac{x-5}{2}$ oe final answer	**2**	**M1** for correct first step e.g. $x=2y+5$ or $2x=y-5$ or $\frac{y}{2}=x+\frac{5}{2}$
10(a)(iii)	$2x^3-11x^2-8x+80$ final answer	**4**	**M1** for $(x-4)(2x+5)(x-4)$ oe **B2** for $2x^3-8x^2-8x^2+5x^2-20x-20x+32x+80$ or for simplified 4 term expression of the correct form with 3 terms correct in final answer or **B1** for 3 terms correct out of 4 from $x^2-4x-4x+16$ or $2x^2-8x+5x-20$
10(b)	0	**2**	**M1** for g(− 2) or $2(x-4)+5$ oe or $3^x=1$ or $g(f(2))=1$

9 $f(x) = (3x+1)(x+5)(x-4)$ $g(x) = 2x-3$ $h(x) = 4^{2x-1}$

(a) Find

(i) $f(0)$

..... [1]

(ii) $g^{-1}(x)$

$g^{-1}(x) =$ ..... [2]

(iii) $gh(2)$.

..... [2]

(b) $g(2x) = 7$

Find the value of x.

$x =$ ..... [2]

(c) Simplify $g(x^2) + gg(x) + 1$.

..... [3]

(d) Find $h^{-1}(16)$.

..... [2]

(e) $f(x) = (3x+1)(x+5)(x-4)$

This can be written in the form $f(x) = ax^3 + bx^2 + cx + d$.

Find the value of each of a, b, c and d.

$a =$ ..... $b =$ ..... $c =$ ..... $d =$ ..... [3]

9(a)(i)	–20	**1**	
9(a)(ii)	$\frac{x+3}{2}$ oe final answer	**2**	**M1** for $x = 2y - 3$ or better or $y + 3 = 2x$ or better or $\frac{y}{2} = x - \frac{3}{2}$ or better
9(a)(iii)	125	**2**	**M1** for g(64) or $2(4^{2x-1}) - 3$
9(b)	2.5 oe	**2**	**M1** for $2(2x) - 3 = 7$ or better
9(c)	$2x^2 + 4x - 11$ final answer	**3**	**B2** for $2x^2$ and either $+4x$ or -11 in final 3 term answer or for correct answer seen then spoiled or **M1** for $2x^2 - 3 + 2(2x - 3) - 3$ [+ 1]
9(d)	1.5 oe	**2**	**M1** for $4^{2x-1} = 4^2$ or better
9(e)	$a = 3$ $b = 4$ $c = -59$ $d = -20$	**3**	**B2** for 3 correct values or for correct unsimplified expanded expression or for simplified four-term expression of correct form with 3 terms correct or **B1** for 2 correct values or for correct expansion of one pair of brackets with at least 3 out of 4 terms correct.

11 $f(x) = 1 - 3x$ $g(x) = (x-1)^2$ $h(x) = \frac{3}{x}, x \neq 0$

(a) Find $g(3)$.

..... [1]

(b) Find $f(x-2)$, giving your answer in its simplest form.

..... [2]

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

$f^{-1}(x) =$ ..... [2]

(d) $\mathrm{gf}(x) - \mathrm{g}(x)\mathrm{f}(x) = 3x^3 + ax^2 + bx + c$

Find the value of each of a, b and c.

$a =$ .....

$b =$ .....

$c =$ ..... [5]

(e) Find $h(x) - f(x)$, giving your answer as a single fraction in its simplest form.

..... [3]

(f) $h(x^n) = 3x^7$

Find the value of n.

$n =$ ..... [1]

11(a)	4	**1**	
11(b)	$7 - 3x$ final answer	**2**	**M1** for $1 - 3(x - 2)$
11(c)	$\frac{1-x}{3}$ oe final answer	**2**	**M1** for $x = 1 - 3y$ or $y - 1 = -3x$ or $1 - y = 3x$ or $\frac{y}{3} = \frac{1}{3} - x$
11(d)	$a = 2, b = 5, c = -1$	**5**	**B4** for two correct values only after correct substitution seen i.e. $(1 - 3x - 1)^2 - (x - 1)^2(1 - 3x)$ or for correct unsimplified expansion or a correct simplified expansion. OR **M1** for $(1 - 3x - 1)^2 - (x - 1)^2(1 - 3x)$ **B2** for correct expansion of $[-](x - 1)^2(1 - 3x)$ $[-](x^2 - x - x + 1 - 3x^3 + 3x^2 + 3x^2 - 3x)$ or better or **B1** for expansion of one pair of brackets $[(x-1)^2 =]x^2 - x - x + 1$ or better or $[(x - 1)(1 - 3x) =] - 3x^2 + x + 3x - 1$
11(e)	$\frac{3 - x + 3x^2}{x}$ final answer	**3**	**B1** for $3 - x(1 - 3x)$ or better **B1** for common denominator x isw
11(f)	-7	**1**	

6 $f(x) = 5x - 3$ $g(x) = 64^x$ $h(x) = \frac{2}{x+1}, \quad x \neq -1$

(a) Find the value of

(i) f(2)

..... [1]

(ii) gf(0.5).

..... [2]

(b) Find $h^{-1}(x)$.

$h^{-1}(x) =$ ..... [3]

(c) Find x when $g(x) = \frac{1}{2^5}$.

$x =$ ..... [2]

(d) Write as a single fraction in its simplest form $\frac{1}{f(x)} - h(x)$.

..... [4]

6(a)(i)	7	**1**	
6(a)(ii)	$\frac{1}{8}$ oe	**2**	**M1** for g(–0.5) or for $64^{5(x)-3}$ or better
6(b)	$\frac{2-x}{x}$ or $\frac{2}{x}-1$ final answer	**3**	**M1** for $y(x+1)=2$ or $x=\frac{2}{y+1}$ or better **M1** for $\frac{2-y}{y}$ or $xy=2-x$ oe
6c	$-\frac{5}{6}$ –0.833 or better	**2**	**M1** for $[64^x=]\ 2^{6x}$ or $(2^6)^x$ or $6x=-5$
6(d)	$\frac{7-9x}{(5x-3)(x+1)}$ or $\frac{7-9x}{5x^2+2x-3}$ or $-\frac{9x-7}{5x^2+2x-3}$ final answer	**4**	**B1** for $\frac{1}{5x-3}-\frac{2}{x+1}$ **M1** for $x+1-2\,(5x-3)$ seen isw **M1** for $(5x-3)(x+1)$ seen isw