



### AS Level

Pt. 1: Index Laws & Surds  
Pt. 3: Simultaneous Equations

Pt. 2: Quadratic Functions  
Pt. 4: Graph Functions & Transformations

### A-Level

Pt. 5: Composite Functions  
Pt. 6: Modulus Functions  
Pt. 7: Partial Fractions

1. Simplify  $(\frac{125x^6}{64})^{\frac{1}{3}}$  (2)
2. Simplify  $\frac{(4\sqrt{x})^3}{6x^{\frac{1}{3}}}$  (2)
3. Express  $9^{3x+2}$  in the form  $3^y$ , giving y in the form  $ax + b$ , where a and b are constants. (2)
4. Express  $16^{4x-10}$  in the form  $4^y$ , giving y in the form  $ax + b$ , where a and b are constants. (2)
5. Given  $y = 2^x$ 
  - a) Express  $4^x$  in terms of y (2)
  - b) Hence, or otherwise, solve  $4^x - 6(2^x) - 16 = 0$  (3)
6. Find the value of x such that  $16^{2x-1} = 8^{4x+2}$  (3)
7. Factorise completely:
  - a)  $x - 25x^3$  (2)
  - b)  $75x - 12x^3$  (2)
8. Expand and Simplify
  - a)  $(4x + 2)(x - 5)(x + 8)$  (2)
  - b)  $(3x - 2)(x - 5)^2$  (2)
9. Find the value of x such that
 
$$\frac{1+x}{x} = \sqrt{5}$$

Giving your answer in the form  $a + b\sqrt{5}$  where a and b are rational numbers. (4)
10. Rationalise  $\frac{6+\sqrt{5}}{3-\sqrt{5}}$  (3)
11. Show that  $\frac{5+2\sqrt{3}}{2+\sqrt{3}}$  can be written as  $4 - \sqrt{3}$  (3)
12. Rationalise  $\frac{5-\sqrt{7}}{6-3\sqrt{7}}$  (3)

## Mark Scheme

1.

$\frac{5x^3}{4}$	<b>M1</b> Numerator <b>M1</b> Denominator
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2.

$\frac{(4\sqrt{x})^3}{6x^{\frac{1}{3}}} = \frac{64x^{\frac{3}{2}}}{6x^{\frac{1}{3}}} = \frac{32}{3} x^{\frac{7}{6}}$	<b>M1</b> <b>M1</b>
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3.

$9^{3x+2} = 3^{2(3x+2)} = 3^{6x+6}$	<b>M1</b> <b>M1</b>
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4.

$16^{4x-10} = 4^{2(2x-10)} = 4^{4x-20}$	<b>M1</b> <b>M1</b>
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5a.

a) $4^x = 2^{2x}$	<b>M1</b>
$= 2^x \times 2^x$ $= y \times y = y^2$	<b>M1</b>

5b.

b) $4^x - 6(2^x) - 16 = 0$ $y^2 - 6y - 16 = 0$	<b>M1</b>
$(y - 8)(y + 2) = 0$ $y = 8$ $y = -2$	<b>M1</b>
$2^x = 8, x = 3$ $2^x = -2, \text{ no solution}$	<b>M1</b>

6.

$2^{4(2x-1)} = 2^{3(4x+2)}$	<b>M1</b>
$2^{8x-4} = 2^{12x+6}$ $8x - 4 = 12x + 6$	<b>M1</b>
$20x = -10$ $x = -\frac{1}{2}$	<b>M1</b>

7a.

$x(1 - 25x^2)$	<b>M1</b>
$x(1 + 5x)(1 - 5x)$	<b>M1</b>

7b.

$3x(25 - 4x^2)$	<b>M1</b>
$3x(5 - 4x)(5 + 4x)$	<b>M1</b>

8a.

$(4x + 2)(x^2 - 3x - 40)$	<b>M1</b>
$4x^3 + 2x^2 - 12x^2 - 6x - 160x - 80$ $4x^3 - 10x^2 - 166x - 80$	<b>M1</b>



8b.

$(3x-2)(x-5)(x-5)$ $(3x-2)(x^2-10x+25)$	M1
$3x^3-2x^2-30x^2+20x+75x-50$ $3x^3-32x^2+95x-50$	M1

9.

$\frac{1+x}{x} = \sqrt{5}$ $1+x = x\sqrt{5}$	M1
$1+x^2 = 5x^2$ $4x^2 = 1$	M1
$x^2 = \frac{1}{4}$	M1
$x = \pm \frac{1}{2}$	M1

10.

$\frac{6+\sqrt{5}}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3-\sqrt{5}}$	M1
$= \frac{18+5+6\sqrt{5}+3\sqrt{5}}{9+5}$	M1
$= \frac{23+9\sqrt{5}}{14}$	M1

11.

$\frac{5+2\sqrt{3}}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}}$	M1
$\frac{10-6-5\sqrt{3}-4\sqrt{3}}{4-3}$	M1
$4-\sqrt{3}$	M1

12.

$\frac{5-\sqrt{7}}{6-3\sqrt{7}} \times \frac{6+3\sqrt{7}}{6+3\sqrt{7}}$	M1
$\frac{30-21+15\sqrt{7}-6\sqrt{7}}{36-63+18\sqrt{7}-18\sqrt{7}}$	M1
$\frac{7+9\sqrt{7}}{-27}$	M1

