2. Algebra 1 – Basic Algebraic operations, Indices and Surds

Evaluation

1.   Evaluate $30 - 3p^2q$ where $p = -1$ and $q = -6$ 2 KU

Simplification

2.   Simplify $4(3x - 2) - 5(4x + 1)$ 3 KU

3.   Remove the brackets and collect like terms $(3a - b)(2a - 5b)$ 2 KU

4.   Remove the brackets and simplify your answer $(2x - 1)(x + 3) + (x - 4)^2$ 4 KU

5.   Remove the brackets and simplify $(3y - 4)^2$ 2 KU

6.   Multiply out the brackets and simplify. $(2x - 3)(3x^2 + 4x - 1)$ 3 KU

Factorisation

7.   Factorise $6x^2 - 9x$ 2 KU

8.   Factorise $4a^2 - 9b^2$ 2 KU

9.   a)   Factorise the expression $9x^2 - y^2$ 1 KU

         b)   Hence simplify $\dfrac{6x + 2y}{9x^2 - y^2}$ 2 KU

10.   a)   Factorise $a^2 - 9b^2$ 1 KU

         b)   Hence simplify $\dfrac{a^2 - 9b^2}{2a + 6b}$ 2 KU

11.   a)   Factorise $x^2 - 9$ 1 KU

         b)   Express $\dfrac{4(5x + 3)}{25x^2 - 9}$ in its simplest form   2 KU

12.   Express $\dfrac{15x - 20}{9x^2 - 16}$ in its simplest form   3 KU

13.   i)   Factorise **completely** $2x^2 - 6x$ 1 KU

         ii)   Express $\dfrac{2x^2 - 6x}{x^2 - 9}$ in its simplest form.   2 KU

14.   Factorise $3x^2 - 13x - 10$ 2 KU

Solve Linear Equations

15. Solve the equation $5 - 2(1 + 3x) = 27$ 3 KU

16. Solve the equation $5 + 3a = a - 15$ 3 KU

Simultaneous Equations

17. Solve **algebraically**, the system of equations $\begin{array}{l} 2a + 4b = -7 \\ 3a - 5b = 17 \end{array}$ 3 KU

18. Solve the system of equations $\begin{array}{l} 5a + 3b = 9 \\ 7a - 2b = 25 \end{array}$ 3 KU

Functions

1. $f(x) = x^2 - 2x$,   evaluate $f(-2)$ 2 KU

2. $h(t) = 15t - 3t^2$ Find $h(-2)$ 2 KU

3. Given that $f(x) = \dfrac{x^3 + x^2 + 2}{5x - 1}$ evaluate $f(-3)$ 3 KU

4. $f(x) = 9 - 6x$

    (a)   Evaluate $f(-3)$ 1 KU
    (b)   Given that $f(t) = 11$, find t 2 KU

5. The function $f(x)$ is given by the formula $f(x) = 3x^2 - 7$, where x is a real number.
    (a)   Find the value of $f(-2)$.   2 KU
    (b)   Find the **values** of a for which $f(a) = 20$.   3 KU

6. $f(x) = \dfrac{4}{x^2}$ find $f\left(\dfrac{1}{2}\right)$ 2 KU

7. $f(x) = 3^x$
    a)   Find $f(4)$ 1 KU
    b)   Given that $f(x) = \sqrt{27}$, find x.   3 KU

8. $f(x) = \dfrac{3}{\sqrt{x}}$ Find the **exact** value of $f(2)$

     Give your answer **as a fraction** with a rational denominator.   2 KU

9. $f(x) = 3\sqrt{x}$ Find the exact value of $f(12)$,

     giving your answer as a **surd, in its simplest form**.   2 KU

Quadratic Equations

1. Solve **algebraically**, the equation $x^2 = 7x$ 3 KU

2. Solve **algebraically**, the equation $6y - y^2 = 0$ 2 KU

3. Solve **algebraically**, the equation $2x^2 - 9x - 5 = 0$ 3 KU

4. Solve for x: $2x^2 + 7x - 15 = 0$ 3 KU

5. Solve the equation $2x^2 + 5x - 12 = 0$ 3 KU

6. Solve the equation $2p^2 - p - 10 = 0$ where p is a real number.   3 KU

7. Two functions are given below:

    $f(x) = x^2 + 2x - 1$
    $g(x) = 5x + 3$

    Find the values of x for which $f(x) = g(x)$ 3 KU

8. Find the two roots of the equation $2x^2 - 3x - 4 = 0$
    (Answer correct to 1 decimal place).   4 KU

9. Solve the equation $x^2 + 2x - 6 = 0$
    Give your answers correct to 2 significant figures.   5 KU

Inequalities

1. Solve the inequality $8 - x > 3(2x + 5)$ 3 KU

2. Solve **algebraically** the inequality $3y < 4 - (y + 2)$ 3 KU

3. Solve the inequality $3 - (x - 6) < 2x$ 3 KU

4. Solve algebraically the inequality $6x - 2 < 5(1 - 3x)$ 3 KU

5. Solve algebraically, the inequality $2 + 5x \geq 8x - 16$ 3 KU

6. Solve the inequality $2 - 5(3x - 2) \geq 4(1 - 3x)$ where x is a **positive integer**.   5 KU

7. An inequality, like $4x + 10 \leq 6x + 2 \leq 3x + 26$, can be solved by

    i)   solving $4x + 10 \leq 6x + 2$ and
         solving $6x + 2 \leq 3x + 26$

    then   ii)   looking carefully at the two sets of answers to decide
                 on the correct solution to the original inequality.

    a)   Solve $3x + 1 \leq 5x + 3 \leq x + 23$ 4 KU

    b)   Write down the set of **all** possible solutions where x is an INTEGER.   1 KU

Changing the subject of the formula

1. $Y = \dfrac{3(2v - w)}{5}$ Change the subject of the formula to v.   3 KU

2. $P = \dfrac{1}{3}(m - s)$ Change the subject of the formula to m 2 KU

3. $L = 8 + \dfrac{6}{Y}$ Change the subject of the formula to Y.   3 KU

4. Change the subject of the formula to k. $d = \dfrac{k - m}{t}$ 2 KU

5. $Q = p^2 + 3T$ Change the subject of the formula to T.   2 KU

6. $M = R^2 t - 3$ Change the subject of the formula to R.   3 KU

7. Change the subject of the formula to b. $A = \sqrt{4b^2 - c}$ 3 KU

8. a) Change the subject of the formula $Q = 2\sqrt{s} + t$,   to s 3 KU

    b) Find the value of s when $Q = 3.5$ and $t = 2.2$ 2 KU

9. The frequency, F hertz of the sound you hear as you drive past a factory siren at a speed of v metres per second is given by the formula
$$F = f\left(1 - \frac{v}{s}\right)$$
where f is the true frequency of the sound emitted by the siren and s is the speed of sound.   Change the subject of the above formula to v.   3 KU

Algebraic Fractions

1. Express as a single fraction in its simplest form $\dfrac{1}{2x} - \dfrac{1}{3x}, \quad x \neq 0$ 2 KU

2. Express as a single fraction in its simplest form

    $$\frac{3}{x} + \frac{2-x}{x^2}, \quad x \neq 0$$ 3 KU

3. Express as a single fraction in its simplest form

    $$\frac{5}{x} - \frac{3}{(x-2)}, \quad x \neq 0 \quad \text{or} \quad x \neq 2$$ 3 KU

Fraction Equations

1. Solve the equation $\dfrac{2x+1}{3} - \dfrac{x}{4} = 2$ 3 KU

2. Solve the equation $\dfrac{x+4}{2} - \dfrac{2x+1}{3} = 1$, where x is a real number.   3 KU

3. Solve **algebraically** the equation $3x - \dfrac{(5x+2)}{4} = 3$ 3 KU

4. Solve the equation $\dfrac{x-3}{2} + \dfrac{2x-1}{3} = 4$ 4 KU

5. Solve this equation for x: $\dfrac{x-2}{3} - \dfrac{x}{2} = \dfrac{1}{4}$ 4 KU

6. Solve **algebraically**, the equation $\dfrac{x}{2} - \dfrac{(x+1)}{3} = 4$ 3 KU

7. Solve **algebraically**, the equation $\dfrac{m}{3} = \dfrac{(1-m)}{5}$ 3 KU

Indices

1.   Evaluate $27^{\frac{2}{3}}$ 2 KU

2.   Express in its simplest form $y^{10} \times \left(y^4\right)^{-2}$ 2 KU

3.   Simplify $a^3(a^{-7} + 5)$ 2 KU

4.   Express $\dfrac{3y^5 \times 4y^{-1}}{6y}$ in its simplest form.   3 KU

5.   Express $\dfrac{y^4 \times y}{y^{-2}}$ in its simplest form.   2 KU

6.   Express $\dfrac{b^{\frac{1}{2}} \times b^{\frac{3}{2}}}{b}$ in its simplest form.   2 KU

7.   Remove the brackets and simplify $b^{\frac{1}{2}}\left(b^{\frac{1}{2}} + b^{-\frac{1}{2}}\right)$ 3 KU

8.   Remove the brackets and simplify $a^{\frac{1}{2}}\left(a + \dfrac{1}{a}\right)$ 2 KU

Surds

1. Express $\sqrt{50}$ as a surd in its simplest form. 1 KU

2. Simplify $\dfrac{\sqrt{72}}{\sqrt{3}}$ 2 KU

3. Simplify $\sqrt{48} - 3\sqrt{3}$ 2 KU

4. Express $\sqrt{32} - \sqrt{2}$ as a surd in its simplest form. 2 KU

5. Express $\sqrt{72} - \sqrt{2} + \sqrt{50}$ as a surd in its simplest form 3 KU

6. Express $\sqrt{32} + \sqrt{8}$ as a surd in its simplest form. 3 KU

7. Multiply out the brackets $\sqrt{2}\left(\sqrt{6} - \sqrt{2}\right)$

Express your answer as a **surd** in its simplest form. 2 KU

8. $f(x) = 3\sqrt{x}$

Find the exact value of $f(12)$, giving your answer as a **surd, in its simplest form**. 2 KU

9. Express $\dfrac{3}{\sqrt{5}}$ as a fraction with a rational denominator. 2 KU

10. Simplify $\dfrac{\sqrt{3}}{\sqrt{24}}$ Express your answer as a fraction with a rational denominator 3 KU

11. $f(x) = \dfrac{3}{\sqrt{x}}$ Find the **exact** value of $f(2)$

Give your answer **as a fraction** with a rational denominator. 2 KU

12. A function f is given by $f(x) = 4^x$

Find the value of $f\left(\dfrac{3}{2}\right)$ 2 KU