2. Algebra 1 – Basic algebraic operations

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 $\frac{2x^2 - 6x}{x^2 - 9}$ 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 $\begin{aligned} 2a + 4b &= -7 \\ 3a - 5b &= 17 \end{aligned}$ 3 KU

18. Solve the system of equations $\begin{aligned} 5a + 3b &= 9 \\ 7a - 2b &= 25 \end{aligned}$ 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 $f(x) = \frac{x^3 + x^2 + 2}{5x - 1}$ 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. $f(x) = \frac{4}{x^2}$ find $f\left(\frac{1}{2}\right)$ 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. $f(x) = \frac{3}{\sqrt{x}}$ 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. $Y = \frac{3(2v - w)}{5}$ Change the subject of the formula to *v*. 3 KU

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

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

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

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

6. $M = R^2t - 3$ 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 $\frac{1}{2x}-\frac{1}{3x}, \quad x \neq 0$ 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

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

Fraction Equations

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

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

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

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

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

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

7. Solve **algebraically**, the equation $\frac{m}{3}=\frac{(1-m)}{5}$ 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 $f\left(\frac{3}{2}\right)$ 2 KU