

All the questions on this sheet are on maths that you should have done at GCSE. They are all things that you have to be able to do without thinking!

All questions must be done **without a calculator** and all working must be shown.

**Bring your solutions to your first maths lesson in September.**

### Types of Numbers

1. Are these numbers rational or irrational? Explain your answer

a)  $\sqrt{5}$                       b)  $3\pi$                       c)  $0.75346$                       d)  $\frac{\sqrt{36}}{9}$

### Fractions

2. Work out the following

a)  $\frac{7}{8} + \frac{5}{6} =$                       b)  $3\frac{4}{7} - 2\frac{3}{4} =$                       c)  $2\frac{3}{5} \times \frac{7}{12} =$                       d)  $3\frac{3}{5} \div 1\frac{3}{4}$

### Indices

3. Express the following in their simplest form

a)  $1000^{\frac{2}{3}}$                       b)  $36^{-\frac{1}{2}}$                       c)  $(2x^2)^4 \times 2x^3$                       d)  $a^4 \div a^{-5}$

### Surds

4. Simplify

a)  $\sqrt{5} \times \sqrt{3}$                       b)  $(\sqrt{3})^2$                       c)  $\frac{\sqrt{48}}{\sqrt{6}}$                       d)  $\sqrt{75} + \sqrt{27}$

5. Rationalise the denominator

a)  $\frac{1}{\sqrt{5}}$                       b)  $\frac{3}{\sqrt{2}}$                       c)  $\frac{5}{2\sqrt{2}}$                       d)  $\frac{2}{3+\sqrt{6}}$

### Brackets & Simple factorising

6. Expand & simplify

a)  $(x + 4)(x - 7)$                       b)  $(2x + 3)(5x - 2)$                       c)  $(x - 5)^2$

7. Factorise the following

a)  $16x^2 - 12x^3$                       b)  $6x^2 - 4x$                       c)  $5x(2x - 1) - 2x(2x - 1)$

### Algebraic fractions

8. Simplify the following

a)  $\frac{2x-1}{4} + \frac{x+3}{5}$                       b)  $\frac{3}{4x-3} - \frac{2}{x}$                       c)  $\frac{x-2}{4x} \times \frac{x^3}{(x-2)^2}$   
 d)  $\frac{5x^2-20}{10x^2}$                       e)  $4 + \frac{x+3}{2x}$                       f)  $\frac{2x-1}{4} \div \frac{x+3}{6x}$

### Changing the subject of a formula

9. Rearrange to make  $x$  the subject

a)  $y = mx + c$                       b)  $\frac{a(x+b)}{c} = d$                       c)  $V = \frac{4}{3}\pi x^3$   
 d)  $2x + 3xy = y$                       e)  $y = 3 + \frac{2}{x-3}$                       f)  $\sqrt{x} = \frac{a\sqrt{x}}{b} - 3$

**Quadratics**

10. Factorise

a)  $x^2 + 13x - 30$

b)  $2x^2 - 3x - 5$

c)  $9x^2 - 36$

11. Solve by factorising

a)  $x^2 + 7x + 6 = 0$

b)  $3x^2 - 13x + 12 = 0$

c)  $2x^2 - 8 = 0$

12. Complete the Square

a)  $x^2 - 4x - 2$

b)  $x^2 + 7x - 8$

c)  $2x^2 + 12x + 25$

**Inequalities**

13. Solve these inequalities

a)  $7x + 5 < 2x$

b)  $30 - 2x \leq 4$

b)  $2x^2 + 3 < 21$

**Simultaneous equations**

14. Solve

a) 
$$\begin{aligned} 3x + 5y &= 21 \\ 4x + 3y &= 17 \end{aligned}$$

b) 
$$\begin{aligned} 3x - 2y &= 17 \\ 2x + 7y &= 3 \end{aligned}$$

c) 
$$\begin{aligned} y &= 3x - 9 \\ 5x + 2y &= 4 \end{aligned}$$

d) 
$$\begin{aligned} y &= 2x - 10 \\ 7x - 2y &= 29 \end{aligned}$$

e) 
$$\begin{aligned} 7x - y &= 10 \\ x &= y - 2 \end{aligned}$$

f) 
$$\begin{aligned} y &= x^2 + 3 \\ y - 2x &= 18 \end{aligned}$$

**Straight line graphs**

15. Find the equation of

- a) a vertical line passing through (5,-2)
- b) a horizontal line passing through (-3,7)
- c) a line with gradient 4 and y intercept -2
- d) a line with gradient -5 passing through (0,8)

16. The points A and B are (-2,5) and (-4,-9)

Find

- a) the gradient of the line passing through A and B
- b) the equation of the line passing through A and B
- c) the distance from A to B

**Other Graphs**

17. Sketch the graph of  $y = x^2 - 8x + 15$ . Label the graph with the co-ordinates of its turning point and the points where it crosses the axes. (Complete the square & factorise!)

18. Find the equation of the tangent to  $x^2 + y^2 = 25$  at the point (3,4). Give your answer in the form  $ax + by + c = 0$ .

19.  $f(x) = x^2$

Sketch the graphs of

- a)  $y = f(x)$
- b)  $y = f(x) + 3$
- c)  $y = f(x + 3)$
- d)  $y = -f(x)$

**Proof**

20. Prove that the sum of any 3 consecutive ODD numbers is a multiple of 3. (Hint: If we write an even number as  $2n$ , how do we write an odd number?)