

## Sixth Form Summer Transition Work

Welcome to Arnewood Sixth! You are about to embark on a busy and important two years of sixth form study.

Sixth form life is very different. You are going to feel much more independent, empowered and responsible for your own learning. The expectation is that this journey is down to you. You need to commit and relish in the challenge of sixth form life; ambition, belief and commitment are essential for your success.

Below is a transition activity designed for you to complete over the late spring into summer in preparation for your chosen course. By completing the task, you will be better prepared for the start of your course. Your A level teachers will check the work in September. Your commitment starts now!

Subject		
Key Question	To complete a GCSE into AS level mathematics Algebra course	
Resource List	<a href="http://www.corbertmaths.com">www.corbertmaths.com</a>  The website contains video tutorials on each topic	All topics appear at GCSE level, grades 7, 8 and 9

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Your Task

To complete all questions 1 – 40.

1. Simplify the following:      These should be done without the use of a calculator

a.	$3^3$	b.	$2^{10}$	c.	$\sqrt{9}$	d.	$16^{\frac{1}{2}}$
e.	$16^{-1}$	f.	$8^{-2}$	g.	$\frac{1}{8^3}$	h.	$8^{\frac{2}{3}}$
i.	$8^{\frac{4}{3}}$	j.	$8^{-\frac{5}{3}}$	k.	$\sqrt[3]{125}$	l.	$4^{-\frac{1}{2}}$

2. Write each of these in the form  $2^k$

a.	$2^3 \times 2^2$	b.	$2^7 \times 2^5$	c.	$2^8 \div 2^5$
d.	$\frac{2^{11}}{2^{13}}$	e.	$(2^5)^7$	f.	$(2^6)^{\frac{1}{2}}$

3. Simplify the following:

a.	$8x^5 \times 30x^{18}$	b.	$\frac{15x^{15}}{3x^7}$	c.	$\frac{15x^7}{45x^{15}}$
d.	$(2x^5)^3$	e.	$(4x^{10})^{0.5}$	f.	$\left(\frac{x^{12}}{16}\right)^{-0.5}$

4. Simplify the following

a.	$(2x^5 \times 3x^4)^2$	b.	$\frac{3x^5 \times 2x^3}{4x \times x^2}$
c.	$\frac{(3x^5 \times 2x^3)^2}{(4x \times x^2)^3}$	d.	$\sqrt[3]{x} \times \sqrt{x} \times \sqrt[4]{x}$

5. Simplify the following

a.

$$\frac{x^2 + x^3}{x}$$

b.

$$\frac{x^2 + x^3}{x^3}$$

c.

$$\frac{8x^3 + 6x}{2x^5}$$

d.

$$\frac{2x^2 + 4x^5 - 9x^6}{6x^3}$$

6. Find the distance between each of these pairs of coordinates:

a.

(2,3) and (8,11)

b.

(2, -3) and (4, -8)

c.

(-1, -3) and (8,10)

d.

(-3, -9) and (3, -1)

7. Find the gradient of the chord joining these pairs of coordinates:

a.

(1,2) and (3,5)

b.

(4,2) and (8,6)

c.

(7, -3) and (4,5)

d.

(-5, -4) and (-2,10)

8. Find the equation of the line passing through these pairs of coordinates:

a.

(2,7) and (5,22)

b.

(-1, -6) and (3,26)

c.

(6, -7) and (-10,25)

d.

$(4, -\frac{1}{2})$  and  $(-4, -\frac{9}{2})$

9. Find the midpoint of each of these pairs of coordinates:

a.

(4,7) and (6,9)

b.

(2, -5) and (14, -9)

c.

(-3,11) and (-8,18)

d.

$(\frac{1}{2}, \frac{3}{2})$  and  $(-\frac{5}{2}, -\frac{21}{2})$

10.

Find the equation of the line, parallel to  $y = 5x - 7$ , that passes through the midpoint of (2,8) and (8, -10).

11. Expand the brackets:

a.

$$(x + 1)(x + 3)$$

b.

$$(x - 5)(x + 5)$$

c.

$$(2x - 1)(2x + 3)$$

d.

$$(3x - 5)(4 - 2x)$$

12. Factorise into a single bracket:

a.

$$x^2 + x$$

b.

$$4x^2 + 8x$$

c.

$$x^3 + x$$

d.

$$9x^3 - 6x$$

e.

$$x^5 + x^3$$

f.

$$18x^7 - 3x^4$$

g.

$$x^{\frac{3}{2}} + x^{\frac{1}{2}}$$

h.

$$x^{\frac{5}{2}} + x^{\frac{3}{2}}$$

13. Factorise each of these using difference of two squares:

a.

$$x^2 - 1$$

b.

$$x^2 - 9$$

c.

$$4x^2 - 1$$

d.

$$9x^2 - 1$$

e.

$$16 - x^2$$

f.

$$25 - 16x^2$$

14. Factorise each of these into double brackets:

a.

$$x^2 + 2x + 1$$

b.

$$x^2 + 4x + 4$$

c.

$$x^2 + 8x + 15$$

d.

$$x^2 + 2x - 24$$

e.

$$x^2 - 2x - 15$$

f.

$$x^2 + 2x - 63$$

g.

$$2x^2 - 5x - 3$$

h.

$$2x^2 - 7x - 15$$

i.

$$3x^2 + 5x - 2$$

j.

$$8x^2 - 2x - 3$$

15. Complete the square for each of these:

a.

$$x^2 + 2x + 3$$

b.

$$x^2 + 4x + 1$$

c.

$$x^2 + 6x - 3$$

d.

$$x^2 - 2x + 9$$

e.

$$x^2 - 10x + 7$$

f.

$$x^2 + 20x + 19$$

g.

$$x^2 - x + 10$$

h.

$$x^2 + 5x - 7$$

Questions 16, 17, 18 and 19 should be done without the use of a calculator

16. Simplify:

- |    |             |    |              |    |             |
|----|-------------|----|--------------|----|-------------|
| a. | $\sqrt{8}$  | b. | $\sqrt{27}$  | c. | $\sqrt{12}$ |
| d. | $\sqrt{48}$ | e. | $\sqrt{200}$ | f. | $\sqrt{75}$ |

17. Simplify:

- |    |                            |    |                               |    |                                       |
|----|----------------------------|----|-------------------------------|----|---------------------------------------|
| a. | $\sqrt{2} \times \sqrt{2}$ | b. | $4\sqrt{3} \times 5\sqrt{3}$  | c. | $8\sqrt{5} \times \frac{\sqrt{5}}{4}$ |
| d. | $\sqrt{2} \times \sqrt{8}$ | e. | $\sqrt{5} \times \sqrt{20}$   | f. | $\sqrt{3} \times \sqrt{15}$           |
| g. | $\sqrt{6} \times \sqrt{2}$ | h. | $3\sqrt{5} \times 4\sqrt{10}$ | i. | $3\sqrt{32} \times 5\sqrt{8}$         |

18. Rationalise the denominator and simplify each of these:

- |    |                      |    |                        |    |                       |
|----|----------------------|----|------------------------|----|-----------------------|
| a. | $\frac{2}{\sqrt{2}}$ | b. | $\frac{5}{\sqrt{5}}$   | c. | $\frac{5}{\sqrt{3}}$  |
| d. | $\frac{8}{\sqrt{7}}$ | e. | $\frac{33}{\sqrt{11}}$ | f. | $\frac{16}{\sqrt{8}}$ |

19. Expand the brackets, showing working to justify your answer.

- |    |   |    |   |
|----|---|----|---|
| a. | $5(2\sqrt{3} - 3)$                            | b. | $6(2 - 5\sqrt{2})$                            |
| c. | $\sqrt{3}(\sqrt{2} - 5)$                      | d. | $\sqrt{5}(3\sqrt{3} + 2\sqrt{2})$             |
| e. | $(\sqrt{2} + 1)(\sqrt{2} - 3)$                | f. | $(\sqrt{3} - 5)(\sqrt{3} + 4)$                |
| g. | $(\sqrt{3} - \sqrt{2})(2\sqrt{3} + \sqrt{2})$ | h. | $(\sqrt{2} - \sqrt{3})(4\sqrt{3} - \sqrt{5})$ |

20.

The points  $A$ ,  $B$  and  $C$  have coordinates  $(-8, -7)$ ,  $(11, -12)$  and  $(-18, 9)$  respectively. Determine which pair of coordinates are furthest away from one another.

Questions 21-30 should be done without the use of a calculator

Find the set of values for which:

- |    |                        |    |                       |
|----|------------------------|----|-----------------------|
| 21 | $x^2 + 7x + 10 \geq 0$ | 22 | $x^2 - 5x + 6 \leq 0$ |
| 23 | $x^2 + x - 12 > 0$     | 24 | $x^2 - 9x + 18 < 0$   |
| 25 | $x^2 - 7x - 18 \leq 0$ | 26 | $x^2 + 11x + 28 > 0$  |
| 27 | $2x^2 - 11x + 12 > 0$  | 28 | $3x^2 + 2x - 8 > 0$   |
| 29 | $3x^2 - 19x - 14 < 0$  | 30 | $2x^2 - 13x + 21 > 0$ |

- 31 Solve the simultaneous equations

$$x + y = 2$$

$$3x^2 - 2x + y^2 = 2$$

- 32 Solve the simultaneous equations

$$x - 3y + 7 = 0$$

$$x^2 + 2xy - y^2 = 7$$

- 33-40 Sketch each curve showing the exact coordinates of its turning point and the point where it crosses the x and y axes.

a  $y = x^2 - 4x + 3$

b  $y = x^2 + 2x - 24$

c  $y = x^2 - 2x + 5$

d  $y = 30 + 8x + x^2$

e  $y = x^2 + 2x + 1$

f  $y = 8 + 2x - x^2$

g  $y = -x^2 + 8x - 7$

h  $y = -x^2 - 4x - 7$

Q1

- |                   |                   |                  |
|-------------------|-------------------|------------------|
| a. 27             | f. $\frac{1}{64}$ | k. 5             |
| b. 1024           | g. 2              | l. $\frac{1}{2}$ |
| c. 3              | h. 4              |                  |
| d. 4              | i. 16             |                  |
| e. $\frac{1}{16}$ | j. $\frac{1}{32}$ |                  |

Q2

- |             |             |
|-------------|-------------|
| a. $2^5$    | e. $2^{35}$ |
| b. $2^{12}$ | f. $2^3$    |
| c. $2^3$    |             |
| d. $2^{-2}$ |             |

Q3

- |                        |                    |
|------------------------|--------------------|
| a. $240x^{23}$         | e. $2x^5$          |
| b. $5x^8$              | f. $\frac{4}{x^6}$ |
| c. $\frac{1}{3}x^{-8}$ |                    |
| d. $8x^{15}$           |                    |

Mark Scheme

Q4

$$\begin{array}{ll}
 \text{a.} & = (6x^9)^2 = 36x^{18} \\
 \text{b.} & = \frac{6x^8}{4x^3} = \frac{3}{2}x^5 \\
 \text{c.} & = \frac{(6x^4)^2}{(4x^3)^2} = \frac{36x^8}{64x^6} = \frac{9}{16}x^2 \\
 \text{d.} & = x^{\frac{1}{2}} \times x^{\frac{1}{3}} \times x^{\frac{1}{4}} \\
 & = x^{\frac{1}{2} + \frac{1}{3} + \frac{1}{4}} \\
 & = x^{\frac{13}{12}}
 \end{array}$$

Q5

$$\begin{array}{ll}
 \text{a.} & = \frac{x^1}{x} + \frac{x^3}{x} = x + x^2 \\
 \text{b.} & = \frac{x^1}{x^3} + \frac{x^3}{x^3} = x^{-2} + 1 \\
 \text{c.} & = \frac{8x^3}{2x^5} + \frac{6x}{2x^5} = 4x^{-2} + 3x^{-4} \\
 \text{d.} & \frac{1}{3}x^{-1} + \frac{2}{3}x^2 - \frac{3}{2}x^3
 \end{array}$$

Q6

$$\begin{array}{ll}
 \text{a.} & d = \sqrt{(2-8)^2 + (3-11)^2} \\
 & = \sqrt{100} = 10 \\
 \text{b.} & d = \sqrt{(2-4)^2 + (-3--8)^2} \\
 & = \sqrt{29} \\
 \text{c.} & d = \sqrt{(-1-8)^2 + (-3-10)^2} \\
 & = \sqrt{250} (= 5\sqrt{10}) \\
 \text{d.} & d = \sqrt{(-3-3)^2 + (-9--1)^2} \\
 & = \sqrt{100} = 10
 \end{array}$$



Q7

$$a. \quad m = \frac{2-5}{1-3} = \frac{-3}{-2} = \frac{3}{2}$$

$$c. \quad m = \frac{-3-5}{2-4} = \frac{-8}{-2} = 4$$

$$b. \quad m = \frac{2-6}{4-8} = \frac{-4}{-4} = 1$$

$$d. \quad m = \frac{-4-10}{-5-2} = \frac{-14}{-7} = 2$$

Q8

$$a. \quad m = \frac{7-22}{2-5} = \frac{-15}{-3} = 5 \quad \text{line: } y-7$$

$$\Rightarrow y =$$

$$b. \quad m = \frac{-6-26}{-1-3} = \frac{-32}{-4} = 8 \quad \text{line: } y+6 = 8(x+1)$$

$$\Rightarrow y = 8x + 2$$

$$c. \quad m = \frac{-7-25}{6--10} = \frac{-32}{16} = -2 \quad \text{line: } y+7 = -2(x-6)$$

$$\Rightarrow y = -2x + 5$$

$$d. \quad m = \frac{-\frac{1}{2}--\frac{9}{2}}{4--4} = \frac{4}{8} = \frac{1}{2} \quad \text{line: } y + \frac{1}{2} = \frac{1}{2}(x-4)$$

$$\Rightarrow y = \frac{1}{2}x - \frac{5}{2}$$

Q9

a.  $\left(\frac{4+6}{2}, \frac{7+9}{2}\right) = (5, 8)$

b.  $\left(\frac{2+14}{2}, \frac{-5-9}{2}\right) = (8, -7)$

c.  $\left(\frac{-3-8}{2}, \frac{11+18}{2}\right) = \left(-\frac{11}{2}, \frac{29}{2}\right)$

d.  $\left(\frac{\frac{1}{2}-\frac{5}{2}}{2}, \frac{\frac{3}{2}-\frac{11}{2}}{2}\right) = \left(-1, -\frac{9}{2}\right)$

Q10

$$y = 5x - 26$$

Q11

a.  $x^2 + 4x + 3$

b.  $x^2 - 25$

c.  $4x^2 + 4x - 3$

d.  $-6x^2 + 22x - 20$

Mark Scheme

Q12

- |                 |                           |
|-----------------|---------------------------|
| a. $x(x+1)$     | e. $x^3(x^2+1)$           |
| b. $4x(x+2)$    | f. $3x^4(6x^3-1)$         |
| c. $x(x^2+1)$   | g. $x^{\frac{1}{2}}(x+1)$ |
| d. $3x(3x^2-2)$ | h. $x^{\frac{1}{3}}(x+1)$ |

Q13

- |                   |                   |
|-------------------|-------------------|
| a. $(x-1)(x+1)$   | e. $(4-x)(4+x)$   |
| b. $(x-3)(x+3)$   | f. $(5-4x)(5+4x)$ |
| c. $(2x-1)(2x+1)$ |                   |
| d. $(3x-1)(3x+1)$ |                   |

Q14

- |                             |
|-----------------------------|
| a. $x^2+2x+1 = (x+1)^2$     |
| b. $x^2+4x+4 = (x+2)^2$     |
| c. $x^2+8x+15 = (x+3)(x+5)$ |
| d. $x^2+2x-24 = (x+6)(x-4)$ |

Mark Scheme

$$e. x^2 - 2x - 15 = (x - 5)(x + 3)$$

$$f. x^2 + 2x - 63 = (x + 9)(x - 7)$$

$$g. 2x^2 - 5x - 3$$

$$= (2x + 1)(x - 3)$$

$$h. 2x^2 - 7x - 15$$

$$= (2x + 3)(x - 5)$$

Mark Scheme

i.  $3x^2 + 5x - 2$

$$= (3x - 1)(x + 2)$$

j.  $8x^2 - 2x - 3$

$$= (2x + 1)(4x - 3)$$

Q15

a.  $x^2 + 2x + 3 = (x + 1)^2 - 1 + 3 = (x + 1)^2 + 2$

b.  $x^2 + 4x + 1 = (x + 2)^2 - 4 + 1 = (x + 2)^2 - 3$

c.  $x^2 + 6x - 3 = (x + 3)^2 - 9 - 3 = (x + 3)^2 - 12$

d.  $x^2 - 2x + 9 = (x - 1)^2 - 1 + 9 = (x - 1)^2 + 8$

Mark Scheme

$$e. x^2 - 10x + 7 = (x-5)^2 - 25 + 7 = (x-5)^2 - 18$$

$$f. x^2 + 20x + 19 = (x+10)^2 - 100 + 19 = (x+10)^2 - 81$$

$$g. x^2 - x + 10 = (x - \frac{1}{2})^2 - \frac{1}{4} + 10 = (x - \frac{1}{2})^2 + \frac{39}{4}$$

$$h. (x + \frac{5}{2})^2 - \frac{53}{4}$$

Q16

$$a. \sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}$$

$$e. \sqrt{200} = \sqrt{100 \times 2} = 10\sqrt{2}$$

$$b. \sqrt{27} = \sqrt{9 \times 3} = 3\sqrt{3}$$

$$f. \sqrt{75} = \sqrt{25 \times 3} = 5\sqrt{3}$$

$$c. \sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$$

$$d. \sqrt{48} = \sqrt{16 \times 3} = 4\sqrt{3}$$

Q17

$$a. \sqrt{2} \times \sqrt{2} = 2$$

$$e. \sqrt{5} \times \sqrt{20} = \sqrt{100} = 10$$

$$b. 4\sqrt{3} \times 5\sqrt{3} = 20 \times 3 = 60$$

$$f. \sqrt{3} \times \sqrt{15} = \sqrt{45} = \sqrt{9 \times 5} = 3\sqrt{5}$$

$$c. 8\sqrt{5} \times \frac{\sqrt{5}}{4} = 2 \times 5 = 10$$

$$g. \sqrt{6} \times \sqrt{2} = \sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$$

$$d. \sqrt{2} \times \sqrt{8} = \sqrt{16} = 4$$

$$h. 3\sqrt{5} \times 4\sqrt{6} = 12\sqrt{50} = 12\sqrt{25 \times 2}$$

$$= 12 \times 5\sqrt{2} = 60\sqrt{2}$$

$$i. 3\sqrt{11} \times 5\sqrt{8} = 15\sqrt{256} = 15 \times 16 = 240$$

**Q18**

<p>a. <math>\frac{2}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{2\sqrt{2}}{2} = \sqrt{2}</math></p> <p>b. <math>\frac{5}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{5\sqrt{5}}{5} = \sqrt{5}</math></p> <p>c. <math>\frac{5}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{3} = \frac{5}{3}\sqrt{3}</math></p>	<p>d. <math>\frac{8}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{8\sqrt{7}}{7} = \frac{8}{7}\sqrt{7}</math></p> <p>e. <math>\frac{33}{\sqrt{11}} \times \frac{\sqrt{11}}{\sqrt{11}} = \frac{33\sqrt{11}}{11} = 3\sqrt{11}</math></p> <p>f. <math>\frac{16}{\sqrt{8}} \times \frac{\sqrt{8}}{\sqrt{8}} = \frac{16\sqrt{8}}{8} = 2\sqrt{8}</math>  <math>= 2\sqrt{4 \times 2} = 2 \times 2\sqrt{2} = 4\sqrt{2}</math></p>
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**Q19**

<p>a. <math>10\sqrt{3} - 15</math></p> <p>b. <math>12 - 30\sqrt{2}</math></p> <p>c. <math>\sqrt{6} - 5\sqrt{3}</math></p> <p>d. <math>3\sqrt{15} + 2\sqrt{10}</math></p>	<p>e. <math>2 - 3\sqrt{2} + \sqrt{2} - 3 = -1 - 2\sqrt{2}</math></p> <p>f. <math>3 + 4\sqrt{3} - 5\sqrt{3} - 20 = -17 - \sqrt{3}</math></p> <p>g. <math>2 \times 3 + \sqrt{6} - 2\sqrt{6} - 2 = 4 - \sqrt{6}</math></p> <p>h. <math>4\sqrt{6} - \sqrt{10} - 4 \times 3 + \sqrt{15}</math>  <math>= 4\sqrt{6} - \sqrt{10} - 12 + \sqrt{15}</math></p>
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**Q20**

**B and C**

21 $x \geq -2, x \leq -5$	22 $2 \leq x \leq 3$
23 $x > 3, x < -4$	24 $3 < x < 6$
25 $-2 \leq x \leq 9$	26 $x < -7, x > -4$
27 $x < \frac{3}{2}, x > 4$	28 $x < -2, x > \frac{4}{3}$
29 $-\frac{2}{3} < x < 7$	30 $x < 3, x > \frac{7}{2}$

31. (1,1) and (0.5,1.5)

32. (-4,1) and (2,3)