



# Christopher Whitehead Sixth Form

## Year 11/12 Summer Holiday Task: Mathematics

1. Simplify fully:

a.  $y^3 \times y^5$       b.  $3x^2 \times 2x^5$       c.  $(4x^2) \div 2x^5$       d.  $4b^2 \times 3b^3 \times b^4$

2. Expand and simplify if possible:

a.  $(x + 3)(x - 5)$       b.  $(2x - 7)(3x + 1)$       c.  $(2x + 5)(3x - y + 2)$

3. Expand and simplify if possible:

a.  $X(x + 4)(x - 1)$       b.  $(x + 2)(x - 3)(x + 7)$       c.  $(2x + 3)(x - 2)(3x - 1)$

4. Expand the brackets:

a.  $3(5y + 4)$       b.  $5x^2(3 - 5x + 2x^2)$       c.  $5x(2x + 3) - 2x(1 - 3x)$       d.  $3x^2(1 + 3x) - 2x(3x - 2)$

5. Factorise these expressions completely:

a.  $3x^2 + 4x$       b.  $4y^2 + 10y$       c.  $x^2 + xy + xy^2$       d.  $8xy^2 + 10x^2y$

6. Factorise:

a.  $X^2 + 3x + 2$       b.  $3x^2 + 6x$       c.  $X^2 - 2x - 35$       d.  $2x^2 - x - 3$   
e.  $5x^2 - 13x - 6$       f.  $6 - 5x - x^2$

7. Factorise:

a.  $2x^3 + 6x$       b.  $X^3 - 36x$       c.  $2x^3 + 7x^2 - 15x$

8. Simplify:

a.  $9x^3 \div 3x^{-3}$       b.  $(4^{3/2})^{1/3}$       c.  $3x^{-2} \times 2x^{-4}$       d.  $3x^{1/3} \div 6x^{2/3}$

9. Evaluate:

a.  $(\frac{8}{27})^{\frac{2}{3}}$       b.  $(\frac{225}{289})^{\frac{3}{2}}$

10. Simplify:

a.  $\frac{3}{\sqrt{63}}$       b.  $\sqrt{20} + 2\sqrt{45} - \sqrt{80}$

11. a. Find the value of  $35x^2 + 2x - 48$  when  $x = 25$ .

b. By factorising the expression, show that your answer to part a can be written as the product of two prime factors.

12. Expand and simplify if possible:

a.  $\sqrt{2}(3 + \sqrt{5})$       b.  $(2 - \sqrt{5})(5 + \sqrt{3})$       c.  $(6 - \sqrt{2})(4 - \sqrt{7})$

13. Rationalise the denominator and simplify:

a.  $\frac{1}{\sqrt{3}}$       b.  $\frac{1}{\sqrt{2}-1}$       c.  $\frac{3}{\sqrt{3}-2}$       d.  $\frac{\sqrt{23}-\sqrt{37}}{\sqrt{23}+\sqrt{37}}$

e.  $\frac{1}{(2+\sqrt{3})^2}$       f.  $\frac{1}{(4-\sqrt{7})^2}$

14. a. Given that  $x^3 - x^2 - 17x - 15 = (x + 3)(x^2 + bx + c)$ , where **b** and **c** are constants, work out the values of **b** and **c**

b. Hence, fully factorise  $x^3 - x^2 - 17x - 15$ .

15. Given that  $y = \frac{1}{64}x^3$  express each of the following in the form  $kx^n$ , where **k** and **n** are constants.

a.  $y^{1/3}$       b.  $4y^{-1}$

16. Show that  $\frac{5}{\sqrt{75} - \sqrt{50}}$  can be written in the form  $\sqrt{a} + \sqrt{b}$ , where **a** and **b** are integers.

17. Expand and simplify  $(\sqrt{11} - 5)(5 - \sqrt{11})$

18. Factorise completely  $x - 64x^3$

19. Express  $27^{2x+1}$  in the form  $3^y$ , stating  $y$  in terms of  $x$ .

20. Solve the equation  $8 + x\sqrt{12} = \frac{8x}{\sqrt{3}}$ . Give your answer in the form  $a\sqrt{b}$  where  $a$  and  $b$  are integers.

21. A rectangle has a length of  $(1 + \sqrt{3})$ cm and an area of  $\sqrt{12}$  cm<sup>2</sup>. Calculate the width of the rectangle in cm. Express your answer in the form  $a + b\sqrt{3}$ , where  $a$  and  $b$  are integers to be found.

22. Show that  $\frac{(2 - \sqrt{x})^2}{\sqrt{x}}$  can be written as  $4x^{-1/2} - 4 + x^{1/2}$

23. Given that  $243\sqrt{3} = 3^a$ , find the value of  $a$ .

24. Given that  $\frac{4x^3 + x^{\frac{5}{2}}}{\sqrt{x}}$  can be written in the form  $4x^a + x^b$ , write down the values of  $a$  and  $b$ .

25. Solve the following equations:

a.  $3x + 6 = x - 4$

b.  $5(x + 3) = 6(2x - 1)$

c.  $4x^2 = 100$

d.  $(x - 8)^2 = 64$

26. Sketch the graphs of the following equations, labelling the points where each graph crosses the axes:

a.  $y = 3x - 6$

b.  $y = 10 - 2x$

c.  $x + 2y = 18$

d.  $y = x^2$

27. Solve the following inequalities, illustrate your answers on a number line:

a.  $x + 8 < 11$

b.  $2x - 5 \geq 13$

c.  $4x - 7 \leq 2(x - 1)$

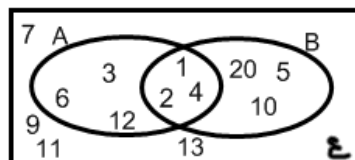
d.  $4 - x < 11$

28.  $A = \{\text{factors of } 12\}$      $B = \{\text{Factors of } 20\}$

Write down the numbers in each of these sets:

a.  $A \cap B$

b.  $(A \cup B)'$



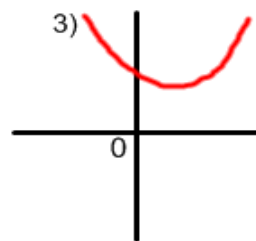
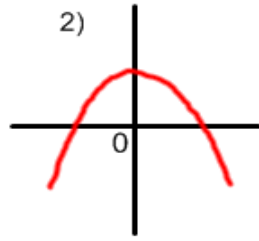
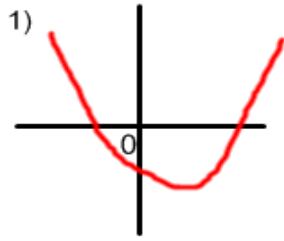
29. Match the equations to the correct graph.

Label the points of intersection with the axes and the coordinates of the turning point.

a.  $y = 9 - x^2$

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

c.  $y = (x - 7)(2x + 5)$



30. a. Copy and complete the table of values for the function  $y = x^3 + x - 2$ .

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y									

b. Use your table of values to draw the graph of  $y = x^3 + x - 2$ .

31. Solve each pair of simultaneous equations:

a.  $y = 2x$

$x + y = 7$

b.  $y = x^2$

$y = 2x + 1$

32. Find the points of intersection of the following pairs of lines.

a.  $y = 4x + 7$  and  $3y = 2x - 1$

b.  $y = 5x - 1$  and  $3x + 7y = 11$

c.  $2x - 5y = -1$  and  $5x - 7y = 14$

33. Make  $y$  the subject of each equation:

a.  $6x + 3y - 15 = 0$

b.  $2x - 5y - 9 = 0$

c.  $3x - 7y + 12 = 0$

34. Write  $x^2 + 4x - 12$  in the form  $(x + a)^2 + b$ . Use this information to find the turning point of  $y = x^2 + 4x - 12$ .