



# **OCR 06 Algebra (Higher)**

- 1. Simplify  $5x^2 \times 4x^{-5}$ .
- 2. Simplify  $8y^{\frac{1}{2}} \div 2y^{\frac{3}{2}}$ .
- 3. A function is given by y = 5x 3. Write an expression for the inverse of this function.
- 4. A value, *x*, is input into this function.

$$x \rightarrow \boxed{\times 2} \rightarrow \boxed{-1} \rightarrow y$$

The output, *y*, is then input into this function.

$$y \rightarrow +4 \rightarrow x_3 \rightarrow z$$

Complete the function below.

$$x \rightarrow \boxed{\qquad} \rightarrow \boxed{\qquad} \rightarrow z$$

5. Find the value of *x* in the following.

$$3(x-4)=2(8-2x).$$

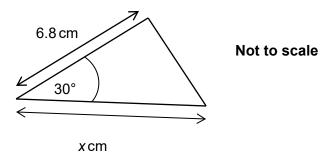
- 6. Write  $x^2 + 8x + 5$  in the form  $(x + a)^2 + b$ .
- 7. Simplify  $\frac{x^2 3x 18}{x^2 + 4x + 3}$ .
- 8. Rearrange the formula  $y = \frac{x+3}{x-2}$  to make *x* the subject.
- 9. Factorise  $3x^2 + 7x 20$ .
- 10. Find the formula for the *n*th term of the quadratic sequence 5, 12, 25, 44, 69, ....
- 11. Kasim adds together two fractions. His working is shown below.

$$\frac{2}{x+1} + \frac{1}{x-2} = \frac{2+1}{x+1+x-2} = \frac{3}{2x-1}$$

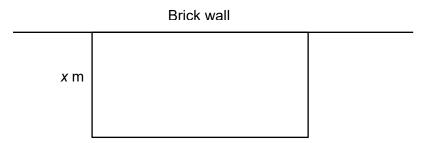
Identify Kasim's error and calculate the correct answer.

## GCSE (9-1) MATHEMATICS Section Check In

- 12. By completing the square, show that the solutions to the equation  $x^2 4x 7 = 0$  are  $x = 2 \sqrt{11}$  and  $x = 2 + \sqrt{11}$ .
- 13. Prove algebraically that the difference between the squares of two consecutive **odd** integers is even.
- 14. A formula for the *n*th term of the sequence 6, 11, 20, 33,... is  $2n^2 n + 5$ . Write down a formula for the *n*th term of the sequence 10, 15, 24, 37,... and use it to show that 240 is a term of this sequence.
- 15. The equation  $x^3 + x 85 = 0$  has a solution between 4 and 5. Show that this solution is 4.3 to one decimal place.
- 16. List the integer values that satisfy both of the inequalities 2y 3 > -5 and 3y + 1 < 13.
- 17. A Fibonacci type sequence is given by  $x_{n+2} = x_n + x_{n+1}$ .  $x_1 = a$  and  $x_2 = b$ . Write expressions for the third and fifth terms. If the third term is 11 and the fifth term is 39, find the values of *a* and *b*.
- 18. The area of the triangle below is 14.28 cm<sup>2</sup>. Find the value of x.



- 19. A straight line has equation y = 2x 1. A circle has equation  $x^2 + y^2 = 9$ . Find the coordinates of the points of intersection of the circle and the straight line. Give your answers correct to 3 significant figures.
- 20. Sarah wants to make a rectangular pen for her rabbits. One side of the pen will be a brick wall and she has 16 m of wire fencing for the other three sides. Find possible values for x if the area of the pen is at least 24 m<sup>2</sup>.





#### Answers

- 1.  $20x^{-3}$
- 2.  $4y^{-1}$

$$3. \quad y = \frac{x+3}{5}$$

4. 
$$x \rightarrow \boxed{\times 6} \rightarrow \boxed{+9} \rightarrow z$$

- 5. 3(x-4) = 2(8-2x) 3x-12 = 16-4x 7x-12 = 16 7x = 28x = 4
- 6. Complete the square:  $x^{2} + 8x + 5 = (x + 4)^{2} - 16 + 5 = (x + 4)^{2} - 11$
- 7.  $\frac{x^2 3x 18}{x^2 + 4x + 3} = \frac{(x 6)(x + 3)}{(x + 1)(x + 3)} = \frac{x 6}{x + 1}$

8. 
$$y = \frac{x+3}{x-2}$$
$$y(x-2) = x+3$$
$$xy - 2y = x+3$$
$$xy - x = 2y+3$$
$$x(y-1) = 2y+3$$
$$x = \frac{2y+3}{y-1}$$

- 9. (3x-5)(x+4)
- 10.  $u_n = 3n^2 2n + 4$
- 11. Kasim has just added the numerators and added the denominators of the fractions. He should have written each fraction over a common denominator and then just added the numerators.

$$\frac{2}{x+1} + \frac{1}{x-2} = \frac{2(x-2) + 1(x+1)}{(x+1)(x-2)} = \frac{2x-4+x+1}{(x+1)(x-2)} = \frac{3x-3}{(x+1)(x-2)}$$

# GCSE (9-1) MATHEMATICS Section Check In

- 12.  $x^{2} 4x 7 = 0$  $(x 2)^{2} 4 7 = 0$  $(x 2)^{2} 11 = 0$  $(x 2)^{2} = 11$  $x 2 = \pm\sqrt{11}$  $x = 2 + \sqrt{11} \text{ or } x = 2 \sqrt{11}$
- 13. Let the two odd numbers be (2x + 1) and (2x + 3)

$$(2x+1)^{2} = 4x^{2} + 4x + 1$$

$$(2x+3)^{2} = 4x^{2} + 12x + 9$$
Subtracting gives
$$(2x+3)^{2} - (2x+1)^{2} = 4x^{2} + 12x + 9 - (4x^{2} + 4x + 1))$$

$$= 4x^{2} + 12x + 9 - 4x^{2} - 4x - 1$$

$$= 8x + 8$$

$$= 8(x+1)$$

If x is an integer, x + 1 is an integer so 8(x + 1) is even.

14. Each term is 4 larger than the corresponding term in the first sequence so the formula for the *n*th term is  $2n^2 - n + 9$ 

 $2n^2 - n + 9 = 240$   $2n^2 - n - 231 = 0$  (2n + 21)(n - 11) = 0 n = -10.5 or n = 11n can only be a positive integer so n = 11 and therefore 240 is a term in the sequence.

- 15. Try x = 4.25,  $x^3 + x 85 = -3.98...$ Try x = 4.35,  $x^3 + x - 85 = 1.66...$ As there is a sign change between x = 4.25 and x = 4.35, 4.3 is a solution to one decimal place.
- 16. 2y 3 > -52y > -2y > -13y + 1 < 133y < 12y < 4

The integers which satisfy both inequalities are in the interval -1 < y < 4 so 0, 1, 2 and 3.

### GCSE (9–1) MATHEMATICS Section Check In

17. The first term is *a*; the second term is *b*; the third term is *a* + *b*; (the fourth term is *a* + 2*b*); the fifth term is 2*a* + 3*b*.

Form two simultaneous equations:  $2a + 3b = 39 \rightarrow 2a + 3b = 39$   $a + b = 11 \times 3 \rightarrow 3a + 3b = 33$ Substituting gives a = -6Substituting gives b = 17

- 18. Area of triangle =  $\frac{1}{2}ab\sin C$  $\frac{1}{2} \times x \times 6.8 \times \sin 30 = 14.28$  $x = \frac{14.28 \times 2}{6.8 \times \sin 30} = 8.4$  cm
- 19. Substitute y = 2x 1 into  $x^2 + y^2 = 9$

$$x^{2} + (2x - 1)^{2} = 9$$
  
$$x^{2} + 4x^{2} - 4x + 1 = 9$$
  
$$5x^{2} - 4x - 8 = 0$$

Using the quadratic formula:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ 

$$x = \frac{4 \pm \sqrt{4^2 - 4 \times 5 \times -8}}{2 \times 5} = 1.7266... \text{ or } -0.9266... \text{ i.e. } 1.73 \text{ or } -0.927 \text{ (to 3 significant figures)}$$

Substitute into y = 2x - 1If x = 1.73, y = 2.46If x = -0.927, y = -2.85

So the coordinates of the points of intersection are (1.73, 2.45) and (-0.927, -2.85).

20. Let the width be x  $x(16-2x) \ge 24$   $-2x^{2} + 16x - 24 \ge 0$  $(x-2)(6-x) \ge 0$ 

 $2 \le x \le 6$  (in metres)



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Assessment Objective	Qu.	Торіс	R	Α	G
AO1	1	Simplify an expression involving products of powers			
AO1	2	Simplify an expression involving quotients of powers			
AO1	3	Write an expression for an inverse function			
AO1	4	Complete a composite function			
AO1	5	Solve a linear equation involving brackets and unknowns on both sides of the equation			
AO1	6	Complete the square			
AO1	7	Factorise a quadratic expression to simplify an algebraic fraction			
AO1	8	Rearrange a formula where the subject appears twice			
AO1	9	Factorise a quadratic expression where $a \neq 0$ or 1			
AO1	10	Find a formula for the <i>n</i> th term of a quadratic sequence			
AO2	11	Add two algebraic fractions			
AO2	12	Solve a quadratic equation by completing the square			
AO2	13	Use algebra to construct a proof			
AO2	14	Use a formula for the <i>n</i> th term of a quadratic sequence			
AO2	15	Find an approximate solution to a cubic equation			
AO3	16	Solve two linear inequalities			
AO3	17	Set up and solve two simultaneous equations to solve a problem involving sequences			
AO3	18	Substitute values into a formula and solve to find an unknown			
AO3	19	Solve linear and quadratic simultaneous equations and use the quadratic formula			
AO3	20	Set up and solve a quadratic inequality in one variable in context			

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