Algebra A

Name: --

Teacher: --

Class: --

Contents

The Language of Algebra

Learning outcomes

1. Use and interpret algebraic notation

2. Use and interpret algebraic notation in context

3. Recognise and understand the concept and vocabulary of expressions, equations, formulae and identities

Starter activity

Find the words in the grid

brackets

equation

expression

formula

identity

simplify

term

variable

S	B	Y	E	R	U	C	A	O	C	N	Z	N	Y	F
G	T	G	J	R	N	X	V	F	E	Q	K	T	C	O
T	M	E	J	T	O	E	I	A	R	P	I	R	W	R
G	N	G	K	H	I	Q	S	U	R	T	K	L	D	M
C	A	H	W	C	T	L	P	M	N	I	S	Y	G	U
H	S	K	B	S	A	B	L	E	R	R	A	T	L	L
C	Y	G	W	F	U	R	D	L	B	E	T	B	Q	A
D	G	P	C	C	Q	I	B	S	N	S	T	E	L	Y
T	L	W	L	Q	E	S	I	M	P	L	I	F	Y	E
R	E	B	M	U	N	Y	N	I	S	L	U	S	Y	Q
Y	U	F	N	M	X	U	E	N	E	B	T	I	K	O
F	F	D	P	S	D	E	D	T	I	H	E	H	C	W
X	V	G	G	Q	I	A	T	M	M	M	A	I	M	Z
Y	N	O	I	S	S	E	R	P	X	E	J	F	L	Z
O	F	F	Q	U	R	Y	Y	W	A	Y	D	B	I	F

The Language of Algebra

Activity 1

Write an expression for each description

1. 6 minus **h**

2. 4 added to **c**

3. **g** minus 5

4. **d** less than **c**

5. **y** multiplied by 5

6. **s** multiplied by **t**

7. **f** multiplied by **f**

8. 4 divided by **r**

9. **t** divided by **v**

10. **s** multiplied by 5 and add 2

11. **t** minus 7 then multiplied by 3

SCORE __ / 11

Activity 2

Answer the questions below

1. In an examination Joanne got x marks

   a) Alan got 6 more marks than Joanne.
      Write an expression for the number of marks Alan got

   b) Brian got 5 times as many marks as Joanne.
      Write an expression for the number of marks Brian got

   c) Charlie got half the marks that Joanne got.
      Write an expression for the number of marks Charlie got

SCORE __ / 3

The Language of Algebra

Activity 3

For each of the following state whether they are an expression, equation, formula or identity

1. $Area = l\,x\,w$

2. $3m + 2 = 5$

3. $2x \equiv x + x$

4. $7n - 3 = 11$

5. $2x + 5y + 3$

6. $a^2 + b^2 = c^2$

7. $5p \equiv 2p + 3p$

8. $2m - 8 = 6$

9. $4t + 6$

10. $2(m + 3) = 16$

11. $6p + 4 \equiv 2(3p + 2)$

12. $2t + 5d$

SCORE __ / 12

The Language of Algebra

Plenary - What have I learnt today?

Substitution

Learning outcomes

1. Evaluate an expression by substituting one or more positive numbers into it

2. Evaluate an expression by substituting one or more positive or negative numbers into it

3. Evaluate complex expressions by substitution

4. Evaluate formulae by substitution

Starter activity

Complete the multiplication grid

Hint
Same signs = positive
Opposite signs = negative

X	-2	-6	3	-4
5	e.g. $-2 \times 5 = -10$			
4				
-2				
-5				

Substitution

Activity 1

Using the values evaluate the expressions $a = 3$ $b = 5$ $c = 7$

1. $4a =$

2. $6a + 7 =$

3. $14 - 2a =$

4. $7b =$

5. $6c + 14 =$

6. $46 - 6c =$

7. $3a + 4b =$

8. $9b - 4c =$

Amy is trying to work out the two values of p for which $4p - p^3 = 3$. Her values are **1** and **2**. Are her values correct? You **must** show your working

SCORE __ / 10

Activity 2

Using the values evaluate the expressions $a = -4$ $b = -3$ $c = -5$

1. $3a =$

2. $4c =$

3. $14 - 3a =$

4. $12 - 3b =$

5. $6b - 2a =$

6. $6c + 5a =$

7. $4 - 6c =$

8. $3a + 4b =$

Amy is trying to work out the two values of p for which $5p - p^3 = 4$. Her values are **1** and **-1**. Are her values correct? You **must** show your working

SCORE __ / 10

Substitution

Activity 3

Using the values evaluate the expressions $a = 3$ $b = -5$

1. $a^2 + b =$ 2. $b^2 - a =$ 3. $3b^2 =$ 4. $5a^2 + b =$

5. $b^3 =$ 6. $3a^2 + 2b^2 =$ 7. $\sqrt{3a - 8b} =$ 8. $\sqrt{2a + 3b^2} =$

If $x = 4$ place the expressions in **ascending** order

$12 - 2x$ $4x + 8$ x^2 $-5x$ x^0

....

SCORE __ / 12

Activity 4

Answer the questions below

1. The formula for the area of a trapezium is $A = \frac{(a+b)h}{2}$.

Calculate the area of a trapezium with the following values:

a) a = 3   b) a = 3.7
    b = 7   b = 6.3
    h = 4   h = 7

2. A taxi firm charges £4 fixed charge plus £5 per kilometre.
   a) Write a formula for the cost of a journey, **C**, of k kilometres.

   b) Use your formula to work out the cost of travelling 7km.

SCORE __ / 7

Substitution

Plenary - What have I learnt today?

Simplifying Expressions

Learning outcomes

1. Simplify expressions by collecting like terms

2. Simplify expressions with multiplication using index laws

3. Simplify algebraic fractions using index laws

Starter activity

1. Write the expressions as a single power

a) $2^3 \times 2^4$ b) $6^2 \times 6^3$ c) 8×8^4

2. Write the expressions as a single power

a) $2^6 \div 2^4$ b) $7^5 \div 7^4$ c) $6^4 \div 6$

3. Evaluate

a) $\dfrac{3^4 \times 3^2}{3^3}$ b) $\dfrac{4^3 \times 4^5}{4^6}$ c) $\dfrac{3^2 \times 3^3 \times 3^5}{3^6}$

Simplifying Expressions

Activity 1

Simplify the expressions by collecting like terms

1. $3a + 5b + 2a + 6b =$
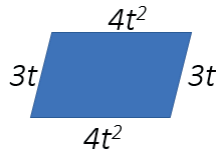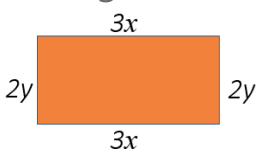
2. $4y + y + 2z + 6z =$

3. $5d + 7 - 2d + 11 =$

4. $7t - 4t + 6 + 2 =$

5. $5t + 3s - 2t - 6s =$

6. $7a - 6b + 2a - 4b =$

Write an expression for the perimeter of the shapes. Simplify the expressions by collecting like terms

$3x$	$4t^2$	$3g + 4$
$2y$ $\quad$ $2y$	$3t$ $\quad$ $3t$	$2h - 1$ $\quad$ $2h - 1$
$3x$	$4t^2$	$3g + 4$
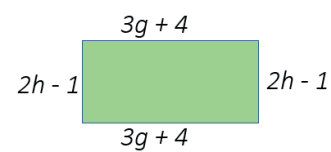
SCORE __ / 12

Activity 2

Simplify the expressions

1. $a \times d =$

2. $8 \times e =$

3. $4c \times 2 =$

4. $8h \times 3 =$

5. $5f \times h =$

6. $s \times 6t =$

7. $4d \times 6e =$

8. $3a \times 5a =$

(This activity continues on the next page)
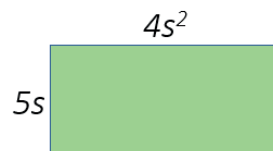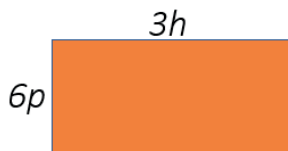
Simplifying Expressions

Activity 2

9) $y \times y^2 =$ 10) $3m \times m^2 =$ 11) $t^2 \times t^2 =$ 12) $3a^4 \times 2a^2 =$

Write an expression for the area of the shapes

3h
6p

4s²
5s

SCORE __ / 14

Activity 3

Simplify the expressions

1. $\dfrac{14b}{2b} =$

2. $\dfrac{3d^2}{d} =$

3. $\dfrac{36c^2}{9c} =$

4. $\dfrac{18b^3}{6b} =$

5. $\dfrac{24y^4}{8y^2} =$

6. $\dfrac{28ab^2}{21b} =$

7. $\dfrac{12d^2e^5}{8de^3} =$

8. $\dfrac{36a^2bc^4}{27ac^3} =$

(This activity continues on the next page)

Simplifying Expressions

Activity 3

Which of the expressions are equivalent?

$$9x^2 \times x^3 \qquad\qquad 3x \times 3x^3 \qquad\qquad \frac{27x^7}{3x^2} \qquad\qquad \frac{18x^6}{3x}$$

SCORE __ / 10

Plenary - What have I learnt today?

Expanding Brackets

Learning outcomes

1. Simplify an algebraic expression by multiplying a single term over a bracket

2. Simplify an algebraic expression by multiplying a single term over a bracket and collecting like terms

3. Apply expanding brackets and simplifying expressions

Starter activity

Fill in the grid by multiplying the numbers in the rows and columns together

x	2	-1	-4	-3	
3	*6*				
5					*-25*
-2			*8*		
-8					
					30

Expanding Brackets

Activity 1

Expand the brackets

1. $2(p + 2) =$

2. $5(s + 4) =$

3. $6(g - 2) =$

4. $7(d - 4) =$

5. $4(3t + 2) =$

6. $2(4s + 2) =$

7. $4(5g - 4) =$

8. $3(2d - 1) =$

9. $r(4r + 3) =$

10. $s(5s - 2) =$

11. $2p(3p + 2) =$

12. $3w(4w - 5) =$

SCORE __ / 12

Activity 2

Expand the brackets and simplify

1. $3(v + 6) + 5(v + 7) =$

2. $5(g - 2) + 2(g + 3) =$

3. $3(a - 6) + 4(a - 2) =$

4. $2(h - 2) - 5(h + 4) =$

5. $3(d - 2) - 8(d - 3) =$
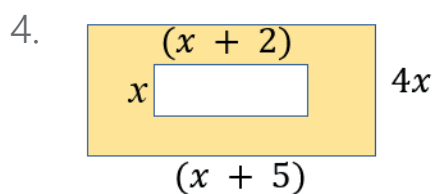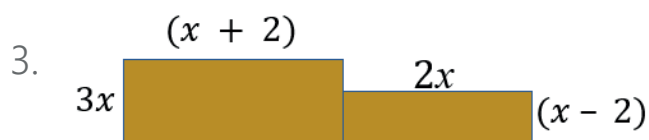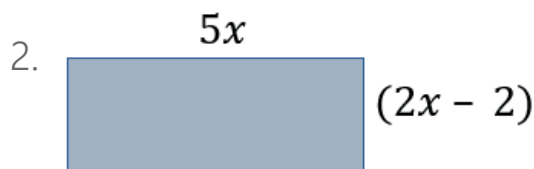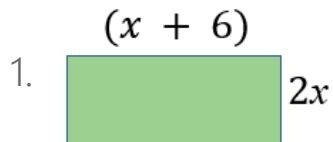
6. $4p(3p + 5) - 3(p - 3) =$

SCORE __ / 12

Expanding Brackets

Activity 3

For each shape
a) Write an expression for the total shaded area
b) Expand and simplify the expressions

1.
$(x + 6)$
$2x$

2.
$5x$
$(2x - 2)$

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

4.
$(x + 2)$
x
$4x$
$(x + 5)$

SCORE __ / 12

Expanding Brackets

Plenary - What have I learnt today?

Expanding two or more brackets

Learning outcomes

1. Expand the product of two binomials

2. Expand the square of a binomial

3. Expand the product of more than two binomials

Starter activity

Expand the following brackets

1. $3(x + 2) =$

2. $5(x - 4) =$

3. $x(8x - 5) =$

4. $4x(x + 5) =$

Expanding two or more brackets

Activity 1

Expand and simplify

1. $(x + 3)(x + 4)$

2. $(x + 6)(x + 9)$

3. $(y + 7)(y + 3)$

4. $(x + 1)(x - 2)$

5. $(t - 5)(t + 4)$

6. $(n + 3)(n - 3)$

7. $(x - 2)(x - 3)$

8. $(x - 6)(x - 1)$

9. $(x - 4)(x - 7)$

Find the missing terms in the quadratic expressions

1.

2.

SCORE __ / 22

Activity 2

Expand and simplify

1. $(x + 5)^2$

2. $(x + 6)^2$

3. $(y + 3)^2$

4. $(x - 2)^2$

5. $(t - 5)^2$

6. $(4 + x)^2$

Expanding two or more brackets

Activity 2

Find the missing terms in the quadratic expressions

1. $(x + ...)^2 = x^2 + ... x + 4$

2. $(x - ....)^2 = x^2 - 12x + ...$

SCORE __ / 16

Activity 3

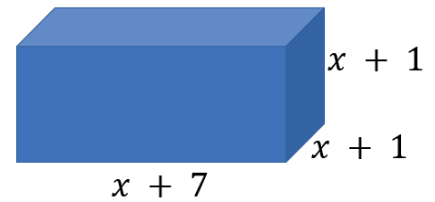Expand and simplify

1. $(x + 4)^3$

2. $(x - 4)(x - 1)(x + 2)$

3. $(3x - 1)(x + 3)(x - 5)$

(This activity continues on the next page)

Expanding two or more brackets

Activity 3

a) Form an expression for the volume of the cuboid

$x + 1$

$x + 1$

$x + 7$

b) Expand and simplify the expression

SCORE __ / 16

Plenary - What have I learnt today?

Factorising Expressions 1

Learning outcomes

1. Factorise linear expressions

2. Factorise complex expressions including indices

3. Factorise quadratic expressions

Starter activity

Expand the brackets and simplify the expressions

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

   c) $5(2x + 1) =$
   d) $x(3x + 1) =$

   e) $2x(3x + 5) =$
   f) $3x(6x - 5) =$

2. a) $(x + 3)(x + 4) =$
   b) $(x - 5)(x + 3) =$

   c) $(x - 4)(x - 5) =$
   d) $(2x + 3)(x - 4) =$

Factorising Expressions 1

Activity 1

Factorise the expressions

a) $3x + 6 =$

b) $2y - 8 =$

c) $5x + 20 =$

d) $4x + 12y =$

e) $9x - 3y =$

f) $xy + 3x =$

g) $5x^2 + 3x =$

h) $4y^2 - 2y =$

i) $12a^2 - 8ab =$

SCORE __ / 9

Activity 2

Factorise the expressions

a) $x^5 + x^3 - x^4 =$

b) $7a^2 + 15a^4 =$

c) $24b^2c^4 - 12c^2 =$

d) $24d^2 - 18d^6 =$

e) $9a^4b + 27a^2b^4 =$

f) $15d^4 - 21c^2 + 18cd =$

SCORE __ / 12

Factorising Expressions 1

Activity 3

Factorise the expressions

1. a) $x^2 + 5x + 6=$ b) $x^2 + 7x + 10=$ c) $x^2 + 8x + 12=$

2. a) $x^2 - 5x + 4=$ b) $x^2 - 15x + 36=$ c) $x^2 - 7x + 10=$

3. a) $x^2 + 5x - 6=$ b) $x^2 - 6x - 7=$ c) $x^2 - x - 72=$

SCORE __ / 18

Factorising Expressions 1

Plenary - What have I learnt today?

Factorising Expressions 2

Learning outcomes

1. Factorise quadratic expressions by finding the difference of two squares

2. Factorise quadratic expressions of the form $ax^2 + bx + c$

Starter activity

Factorise the expressions

a) $x^2 + 7x + 10 =$

b) $x^2 + 9x + 14 =$

c) $x^2 - x - 6 =$

d) $x^2 - 2x - 3 =$

e) $x^2 - 5x + 4 =$

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

Factorising Expressions 2

Activity 1

Factorise the expressions

1. a) $x^2 - 25 =$　　　　　b) $x^2 - 81 =$　　　　　c) $x^2 - 121 =$

2. a) $36x^2 - 16 =$　　　　b) $25x^2 - 1 =$　　　　　c) $27x^2 - 12 =$

SCORE __ / 12

Factorising Expressions 2

Activity 2

Factorise the expressions

1. a) $3x^2 + 8x - 3 =$

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

   c) $4x^2 + 4x - 15 =$

   d) $2x^2 + 11x - 21 =$

   e) $5x^2 - 9x - 2 =$

   f) $15x^2 + 2x - 1 =$

SCORE __ / 18

Factorising Expressions 2

Plenary - What have I learnt today?

Rearranging Formula

Learning outcomes

1. Change the subject of simple formulae

2. Change the subject of more complex formulae

3. Change the subject of formulae where the subject appears twice

Starter activity

Solve the following one and two step equations:

1. $x + 4 = 8$

2. $7p = -49$

3. $c^2 = 64$

4. $f^2 - 4 = 21$

5. $2g - 5 = 6$

6. $p^3 - 7 = 20$

Rearranging Formula

Activity 1

Change the subject of the formula to the variable in brackets

1. $x - 4 = 2y$ (y)

2. $3 - f = \dfrac{t}{4}$ (t)

3. $t = 4r + 3t$ (r)

4. $\dfrac{u}{3} + 4 = 2 - y$ (u)

5. $3p - 4 = y - p$ (p)

6. $h^2 = 4g + 5$ (g)

SCORE __ / 12

Activity 2

Change the subject of the formula to the variable in brackets

1. $\pi^2 + 3 = 2y$ (π)

2. $t - 4 = \sqrt[3]{\dfrac{f}{2}}$

3. $v^2 = u^2 + 2ax$ (a)

(This activity continues on the next page)

Rearranging Formula

Activity 2

4. $(a+3)^2 = g \ (a)$

5. $p^2 + 4p + 4 = t \ (p)$

6. $\dfrac{h^2 + t}{3} = y \ (h)$

SCORE __ / 18

Activity 3

Make x the subject of the formulae

1. $a(x - b) = cx + d$

2. $ax - b = cx + d$

3. $x = \dfrac{ax+b}{c}$

4. $\dfrac{x}{ab} = cx + d$

5. $\dfrac{a}{x} + b = \dfrac{c}{x} + d$

6. $\dfrac{x}{a} + b = cx + d$

SCORE __ / 18

Rearranging Formula

Plenary - What have I learnt today?

Generating Sequences

Learning outcomes

1. Generate terms of sequences using the term to term rule

2. Generate terms of sequences using the position to term rule

3. Generate terms of sequences including patterns and diagrams

4. Generate terms of more complex sequences

Starter activity

What do the following sequences represent? Can you continue them?

a) M, T, W, T, ...

b) J, F, M, A, M, J, J, ...

c) O, T, T, F, F, S, ...

d) Z, Y, X, W, V, ...

Generating Sequences

Activity 1

1. For each of the following describe the term to term rule and find the next three terms

   a) 3, 7, 11, ...

   b) 11, 18, 25, ...

   c) 9, 6, 3, ...

   d) 5, 11, 17, ...

   e) −4, −1, 2, ...

   f) 29, 25, 21, ...

   g) 5, 3, 1, ...

   h) 0, −4, −8, ...

   i) $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}, ...$

2. Find the missing terms in the linear sequences

   a) 2 ,....., 8 ,.....,14

   b) 4 ,....., 10 , ... , ...

   c) ..... , 9 , ... 17, ...

   d) 5,..... , ..., 14, ...

   e) 17, ..., ..., 5 , ...

   f) ....., 16 , ... , ... , 7 , ...

SCORE __ / 15

Activity 2

1. Use the nth term of the sequences to calculate the first 4 terms

   a) 2n + 3=

   b) 4n + 3=

   c) 4n - 1=

(This activity continues on the next page)

Generating Sequences

Activity 2

2. Use the nth term of the sequences to calculate the 1st, 5th, 12th and 50th terms

  a) 9n - 5=
                b) -2n - 3=
                c) -12n + 36=

SCORE __ / 12

Activity 3

For each sequence of patterns:
  a) Draw the next two patterns in the sequence
  b) Predict the number of matchsticks needed for pattern 6

Pattern 1   Pattern 2   Pattern 3

Pattern 1   Pattern 2   Pattern 3

SCORE __ / 6

Activity 4

1. Find the next 2 terms of the Fibonacci sequences

a) 3,6,9,15, ...   b) 15,23,38,62, ...

(This activity continues on the next page)

Generating Sequences

Activity 4

2. Find the next missing terms of the Fibonacci sequences

a) ......, 13, 20, 33   b) 6, ..., 4, 2

3. Find the next 2 terms of the geometric sequences

a) 1, 4, 16, 64,....   b) 6, 12, 24, 48,....

4. Find the next missing terms of the geometric sequences

a) 1, ..., 4, 8, ...   b) 2, ..., 18, 54, ...

SCORE __ / 8

Plenary - What have I learnt today?

Finding the nth term of sequences

Learning outcomes

1. Find the nth term of a linear sequence

2. Find the nth term in a sequence of diagrams

3. Apply the nth term to identify terms in a sequence and decide if a given value is a term in the sequence

4. Find the nth term of a geometric sequence

Starter activity

Find the term to term rule and the next three terms of the sequences

a) 6, 15, 24, 33, ...

b) 42, 50, 58, 66, ...

c) 93, 86, 79, 72, ...

d) 126, 115, 104, 93, ...

e) 7.1, 9.4, 11.7, 14, ...

Finding the nth term of sequences

Activity 1

1. Find the nth term for the sequences

a) 4, 6, 8, 10,...

b) 2, 8, 14, 20,....

c) 2, 5, 8, 11, ...

d) 5, 3, 1, −1, ...

e) −5, −7, −9, −11, ...

f) 6, 23, 40, 57, ...

2. Find the nth term for the sequences and use this to find the 50th term of the sequence

a) 7, 13, 19, 25,...

b) 6, 16, 26, 36,...

c) 10, 8, 6, 4, ...

d) 40, 37, 34, 31, ...

SCORE __ / 14

Finding the nth term of sequences

Activity 2

For each pattern find the nth term of the sequence of patterns and find the number of matches needed for the 100th pattern

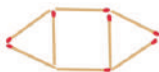Pattern 1   Pattern 2   Pattern 3

Pattern 1   Pattern 2   Pattern 3

SCORE __ / 6

Activity 3

1. The nth term of a sequence is $4n-1$
   a) Which term has a value of 51?

   b) Which is the first term to have a value greater than 100?

   c) Is 74 a term in the sequence?

2. The nth term of a sequence is $15-3n$
   a) Which term has a value of -9?

   b) Which is the first term to have a value less than -50?

   c) Is -32 a term in the sequence?

SCORE __ / 6

Finding the nth term of sequences

Activity 4

1. Find the nth term of the geometric sequences

a) 3, 15, 75, 325, ...

b) 2, 14, 98, 686, ...

c) 11, 22, 44, 88, ...

d) 4, 20, 100, 500, ...

2. Find the nth term of the geometric sequences, use this to find the 10th term of the sequences

a) 4, 6, 9, 13.5, ...

b) 2, 20, 200, 2000, ...

SCORE __ / 8

Plenary - What have I learnt today?

Quadratic Sequences

Learning outcomes

1. Recognise and understand quadratic sequences

2. Use the nth term of a quadratic sequence to generate terms

3. Find the nth term of a quadratic sequence

Starter activity

1. For the equation $y = x^2 + 2$ calculate the value of y for the following values of x:

a) $x = 5$ b) $x = 7$ c) $x = -3$

2. For the equation $y = 2x^2 + 4x - 3$ calculate the value of y for the following values of x:

a) $x = 3$ b) $x = 8$ c) $x = -2$

Quadratic Sequences

Activity 1

By calculating the first and possibly the second differences identify if the following are quadratic sequences

a) 2, 5, 10, 17, 26, ...

b) 5, 13, 21, 29, 37,...

c) 3, 6, 12, 24, 48, ...

d) 2, 3, 5, 8, 13, ...

SCORE __ / 4

Activity 2

1. Generate the first 4 terms and the 10th term of the sequences: (3 marks each)
   a) $n^2 + 1$

   b) $n^2 + 10$

2. Generate the first 4 terms and the 10th term of the sequences:
   a) $2n^2 + 5$

   b) $3n^2 - 4$

3. Generate the first 4 terms and the 10th term of the sequences:
   a) $2n^2 + 2n + 4$

   b) $3n^2 - 4n + 2$

SCORE __ / 18

Quadratic Sequences

Activity 3

Find the nth term of the sequences   (3 marks each)

a) 3, 6, 11, 18, 27, ...

b) −8, −5, 0, 7, 16, ...

c) 7, 16, 31, 52, 79, ...

d) 10, 23, 44, 73, 110, ...

e) 6, 24, 52, 90, 138, ...

SCORE __ / 15

Quadratic Sequences

Plenary - What have I learnt today?

Notes

$Y = 084^x$

$X + Y = 3$

$\sqrt{\dfrac{X}{Y}} = C$

$a^2 + b^2 = X$

$Q = (y_1 - bx_1 - a)^2 +$

$\sin A = \dfrac{1}{2}$

$k = \pm \dfrac{1}{3}$

$a + kb$