Advanced Mathematics
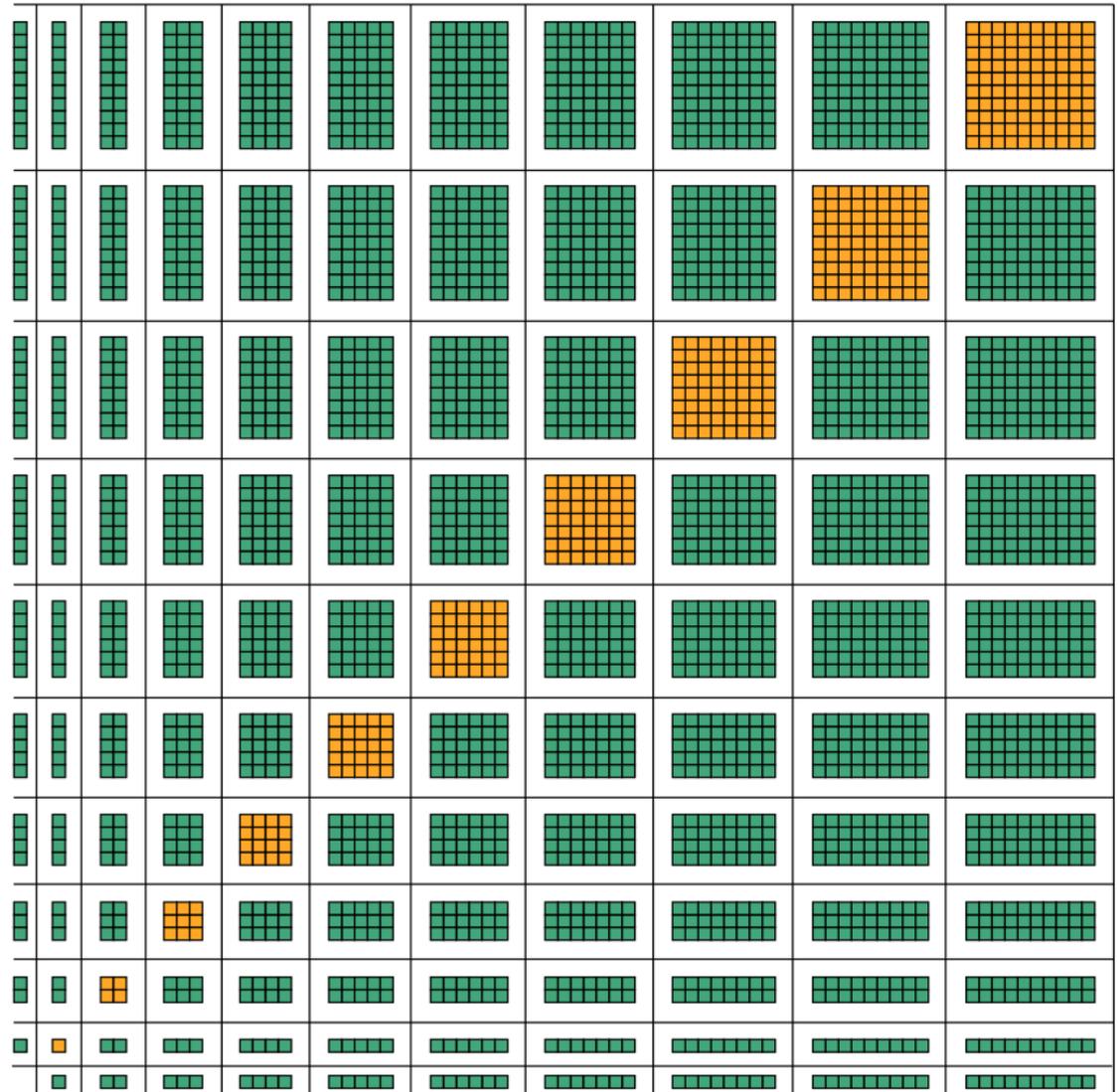# Support Programme®

This is a visual representation of a multiplication square.

What do you notice?

Can you see

- square numbers?
- prime numbers?

Expanding 1

1. Which of the following are the same as

$$3(4 + 10)$$

| 3 x 4 + 10 | (3 x 4) +(3 x10) |
| 3 x 14 | 3 + 14 |

2. Which of these are the same calculation as

$$24 \times 14$$

| 12 x 2 x 14 | 6 x 4 x 2 x 14 |
| 3 x 7 x 8 x 2 | 2 x 7 x 6 x 4 |

3. Expand $4(x + 5)$

4. Calculate $\dfrac{5}{6}(2 + \dfrac{3}{5})$

   give your answer in simplest form

5. Which expression is the odd one out?

| (20 x 8) + (4 x 8) | 2 x 4 x 2 x 6 |
| (12 x 8) + (12 x 8) | 8(20 + 4) | 24 x 8 |

6. Which of these expressions are the same

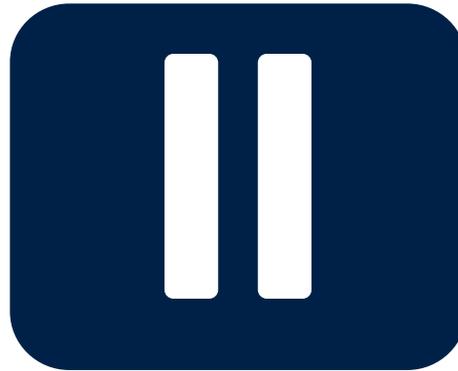| $12(x + 1)$ | $4(3x + 2)$ |
| $2(6x + 3)$ | $6(2x + 1)$ |

7. Expand $-3(2y + x)$

8. 4 people have $(x + 3)$ apples each and 5 people have $(x - 4)$ apples each.

   Write an expression, in its simplest form, for the total number of apples

Expanding 1

Solutions on the next 2 slides….

1. Which of the following are the same as

   $3(4 + 10)$

   →

$3 \times 4 + 10$	$(3 \times 4) + (3 \times 10)$
3×14	$3 + 14$

2. Which of these are the same calculation as

   24×14

   →

$12 \times 2 \times 14$	$6 \times 4 \times 2 \times 14$
$3 \times 7 \times 8 \times 2$	$2 \times 7 \times 6 \times 4$

3. Expand $4(x + 5)$

   → $= 4x + 20$

4. Calculate $\dfrac{5}{6}\left(2 + \dfrac{3}{5}\right)$

   give your answer in simplest form

   → $= \dfrac{5}{6} \times 2 + \dfrac{5}{6} \times \dfrac{3}{5} = \dfrac{10}{6} + \dfrac{15}{30}$

   $= \dfrac{10}{6} + \dfrac{3}{6} = \dfrac{13}{6} = 2\dfrac{1}{6}$

5. Which expression is the odd one out?

$(20 \times 8) + (4 \times 8)$ $2 \times 4 \times 2 \times 6$

$(12 \times 8) + (12 \times 8)$ $8(20 + 4)$ 24×8

All the other expressions = 192

6. Which of these expressions are the same?

$12(x + 1)$ $4(3x + 2)$

$2(6x + 3)$ $6(2x + 1)$

7. Expand $-3(2y + x)$ → $= -6y - 3x$

8. 4 people have $(x + 3)$ apples each and 5 people have $(x - 4)$ apples each.

No. of apples for 4 people $4(x + 3) = 4x + 12$

No. of apples for 5 people $5(x - 4) = 5x - 20$

Write an expression, in its simplest form, for the total number of apples

Total number of apples $= 4x + 12 + 5x - 20$
$$= 9x - 8$$

Unsure about any of these? Search 🔑 Expanding single brackets

Have a go at doing this sum in your head

3 x 7 x 2 x 4 x 5

Did you multiply from left to right?

This is my suggestion…

3 x 7 x 2 x 4 x 5

(2 x 5) x ((3 x 7) x 4)

(10) x ((21) x 4)

(10) x (84)

840

- Why have I done it like this?
- What do the brackets represent?

As you can see the order of multiplication doesn't matter but changing the order can make the calculation easier !
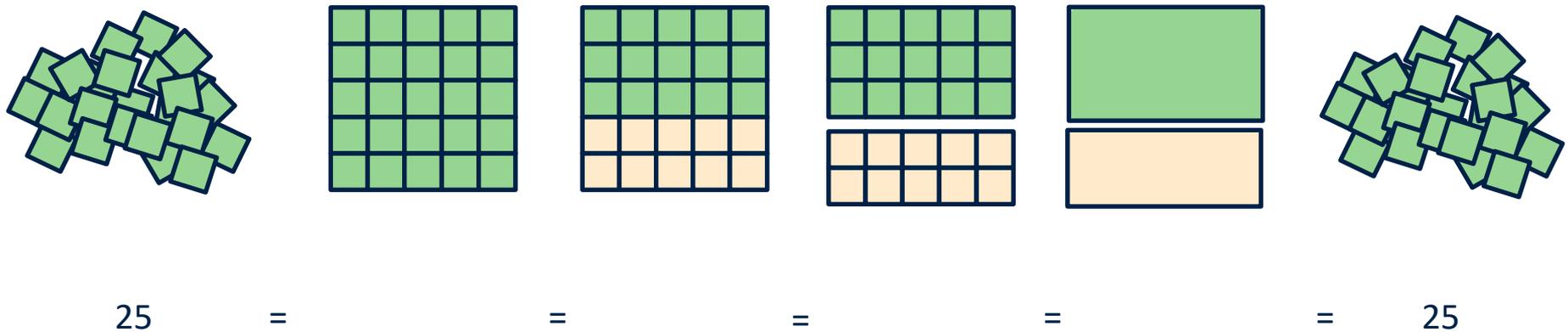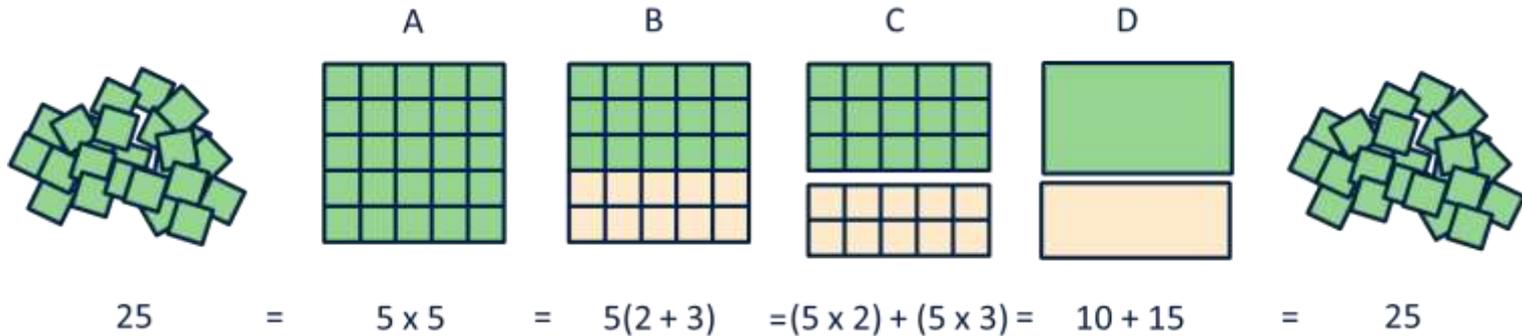
Click here to try a multiplication card sort.

You can join the activity without signing in or entering your real name.

Geometrical Interpretations

48   =   6 x 8   =   6 (3 + 5)   =(6 x 3) + (6 x 5) =   18 + 30   =   48
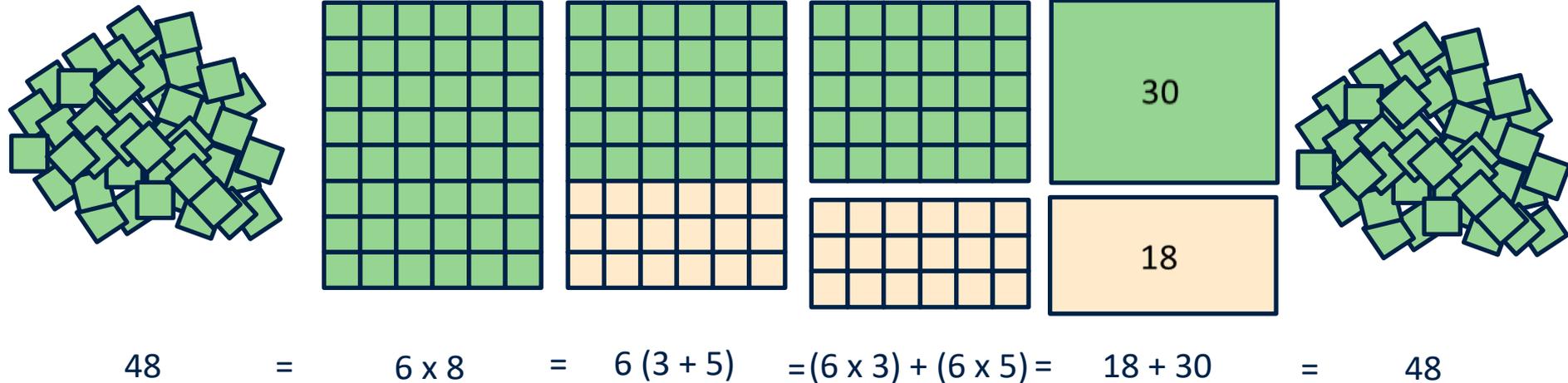
Use the example above to complete the one below

25   =   =   =   =   =   25

$$25 \quad = \quad 5 \times 5 \quad = \quad 5(2+3) \quad = (5 \times 2) + (5 \times 3) = \quad 10 + 15 \quad = \quad 25$$

Complete the table in a similar manner:

Total	A	B	C	D	Total
81	9 x 9	9(3 + 6)			
	5 x 12		(5 x 4) + (5 x 8)		
	… x 8			27 + 45	72
	15 x …			… + 30	90
144			(… x 7) + (… x 5)		
		3(… + 4)			36

Geometrical Interpretations

Solutions on the next slide….

Geometrical Interpretations

$$25 = 5 \times 5 = 5(2+3) = (5 \times 2) + (5 \times 3) = 10 + 15 = 25$$

Total	A	B	C	D	Total
81	9 x 9	9(3 + 6)	(9 x 3) + (9 x 6)	27 + 54	81
60	5 x 12	5(4 + 8)	(5 x 4) + (5 x 8)	20 + 40	60
72	9 x 8	9(3 + 5)	(9 x 3) + (9 x 5)	27 + 45	72
90	15 x 6	15(4 + 2)	(15 x 4) + (15 x 2)	60 + 30	90
144	12 x 12	12(7 + 5)	(12 x 7) + (12 x 5)	84 + 60	144
36	3 x 12	3(8 + 4)	(3 x 8) + (3 x 4)	24 + 12	36

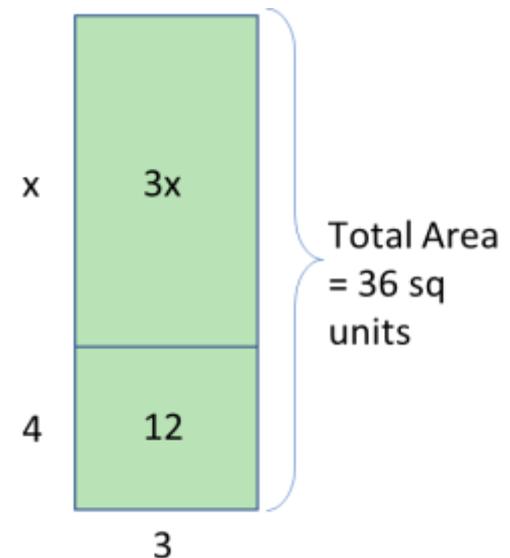| A	B	C	D

25 = 5 x 5 = 5(2 + 3) = (5 x 2) + (5 x 3) = 10 + 15 = 25

How does what you have been doing relate to the equations below?
Try drawing diagrams to illustrate your explanations

1. $3(x + 4) = 36$ ⟶ e.g.

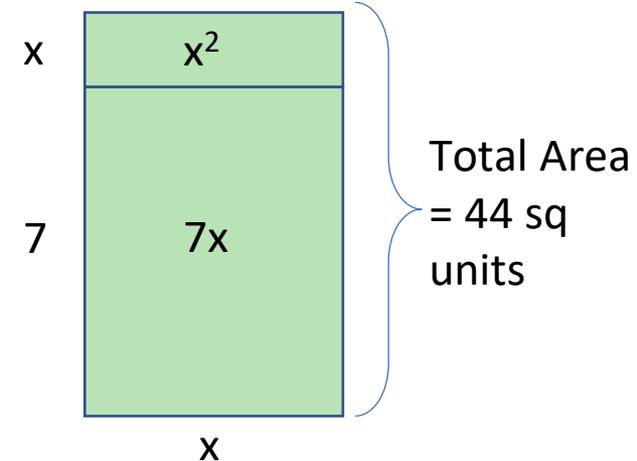2. $5(x + 3) = 35$

3. $x(x + 7) = 44$

4. $5(x + y + 4) = 45$

x   3x

4   12

Total Area = 36 sq units

3

Algebraic Application

1. $3(x + 4) = 36$

2. $5(x + 3) = 35$

3. $x(x + 7) = 44$

4. $5(x + y + 4) = 45$

Diagram 1 (top right):
- x | 5x
- 3 | 15
- width = 5
- Total Area = 35 sq units

Diagram 2 (bottom left):
- x | 5x
- y | 5y
- 4 | 20
- width = 5
- Total Area = 45 sq units

Diagram 3 (bottom right):
- x | x^2
- 7 | 7x
- width = x
- Total Area = 44 sq units
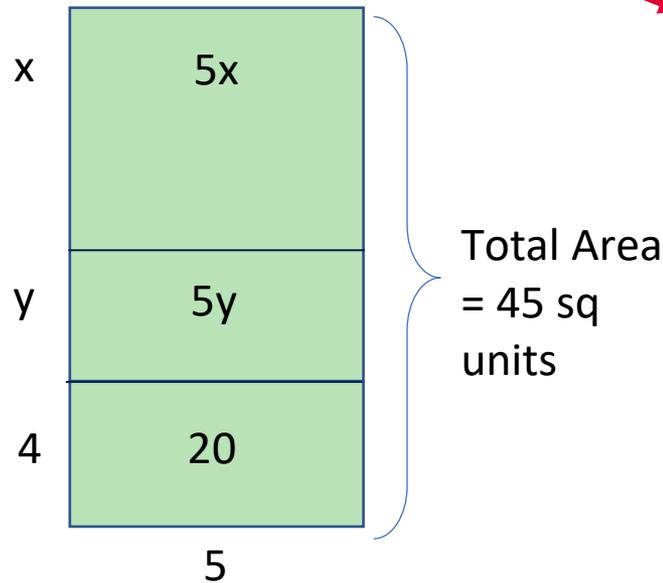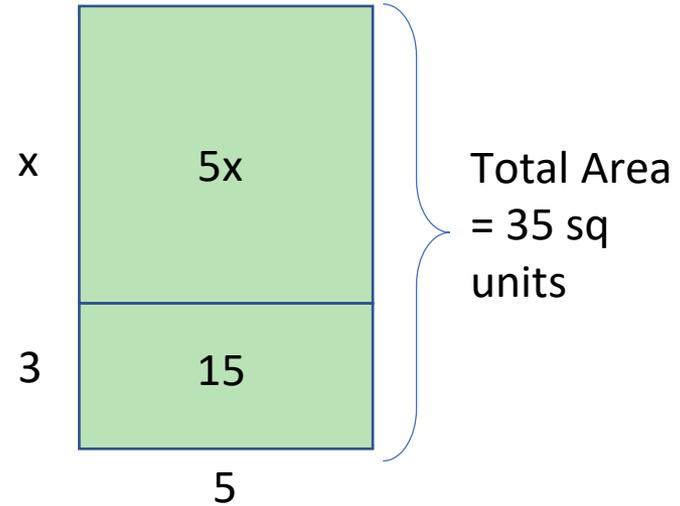
Match it up!

Click here to try an algebraic card sort.
You can join the activity without signing in or entering your real name.

In each of the four sets of expressions one is not the same as the rest can you find it?

- $(3x + 4y) + 2(x + 2y)$

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

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

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

- $(x + 3)(x + 7)$

- $x(x + 3) + 7(x + 3)$

- $x(x + 2) + 7(x + 2) + x + 7$

- $x(x + 4) + 6(x + 3)$

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

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

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

- $x(x + 3) + 4(x + 3) + (x + 3)$

- $x(x - 6) - (-2x) - 2(x - 6)$

- $x(x - 6) + 2(x - 6)$

- $x(x - 2) - 2(x - 2) - 2(x - 4)$

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

In each of the four sets of expressions one is not the same as the rest can you find it?

- $(3x + 4y) + 2(x + 2y)$

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

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

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

- $(x + 3)(x + 7)$

- $x(x + 3) + 7(x + 3)$

- $x(x + 2) + 7(x + 2) + x + 7$

- $x(x + 4) + 6(x + 3)$

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

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

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

- $x(x + 3) + 4(x + 3) + (x + 3)$

- $x(x - 6) - (-2x) - 2(x - 6)$

- $x(x - 6) + 2(x - 6)$

- $x(x - 2) - 2(x - 2) - 2(x - 4)$

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

Expanding 2

1. Expand $y(2y - 3)$

2. Expand $2x^2(3xy - 2x^3)$

3. Expand and simplify
$$5(x - 4) + 3(2x + 5)$$

4. Expand and simplify
$$4(\sqrt{2} - 3) + 2(\sqrt{2} + 2)$$

5. Multiply the expressions y and $y + 4$
Which of these expressions show the result?

$$5y \qquad y(y + 4) \qquad y^2 + 4y \qquad 4y + 4$$

6. A rectangle of width 3 cm and width $x + 4$ cm, is made larger by doubling its side lengths. What is the area, in cm², of the larger rectangle ?

7. Expand and simplify $4 - 3(2 - a + t) - t$

8. Expand and simplify $\dfrac{a}{2}(3 + \dfrac{a}{4}) + \dfrac{a}{3}(2 + \dfrac{a}{2})$

Expanding 2

Solutions on the next slide….

1. Expand $y(2y-3)$ ⟶ $= 2y^2 - 3y$

2. Expand $2x^2(3xy - 2x^3)$ ⟶ $= 6x^3y - 4x^5$

3. Expand and simplify
$$5(x-4) + 3(2x+5)$$
   ⟶ $= 5x - 20 + 6x + 15 = 11x - 5$

4. Expand and simplify
$$4(\sqrt{2} - 3) + 2(\sqrt{2} + 2)$$
   ⟶ $= 4\sqrt{2} - 12 + 2\sqrt{2} + 4 = 6\sqrt{2} - 8$

5. Multiply the expressions y and $y + 4$
Which of these expressions show the result? →

$5y$ | y(y+4) | $y^2 + 4y$ | 4y + 4

6. A rectangle of width 3 cm and width $x + 4$ cm, is made larger by doubling its side lengths. What is the area, in cm², of the larger rectangle ? →

new length $= 2x + 8$
new width $= 6$
Area$= 6(2x + 8)$ or $(12x + 48)cm^2$

7. Expand and simplify $4 - 3(2 - a + t) - t$ →

$$= 4 - 6 + 3a - 3t - t$$
$$= 3a - 4t - 2$$

8. Expand and simplify $\frac{a}{2}(3 + \frac{a}{4}) + \frac{a}{3}(2 + \frac{a}{2})$ →

$$= \frac{3a}{2} + \frac{a^2}{8} + \frac{2a}{3} + \frac{a^2}{6} = \frac{a^2}{8} + \frac{a^2}{6} + \frac{3a}{2} + \frac{2a}{3}$$

$$= \frac{3a^2}{24} + \frac{4a^2}{24} + \frac{36a}{24} + \frac{16a}{24}$$

$$= \frac{7a^2 + 52a}{24}$$

Still want more?

Read minds with maths! Have a go at this number trick and then not only impress friends and family but discover how it is done and create your own tricks.

Discover and use algebra to prove why something is true. There is a **solution** if you need it.

Watch more mathematical hocus pocus in this video - *you will be astounded!* The result you'll discover is used in many area of physics, including string theory, so it's not hocus pocus after all!

Contact the AMSP

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🐦 Advanced_Maths