Planner

Formulae

- Finding the value of a formula
- Obtaining a formula
- Checking that a formula works

Keywords

You should know

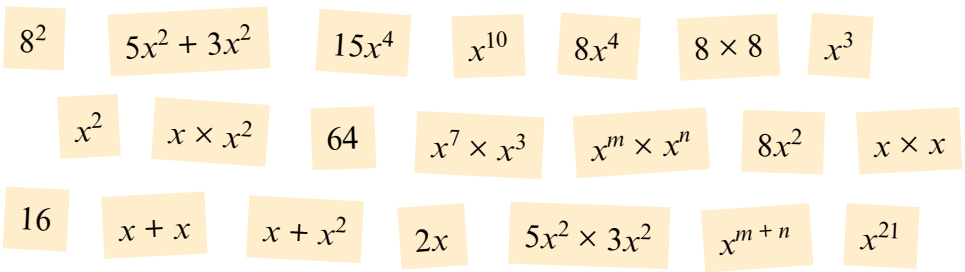
explanation 1

1 Fatima thinks 7^2 is 14. What mistake has she made?

2 Sam has made mistakes. Copy his work out correctly.
Explain how each calculation should be done.

a $2 \times 5^2 = 100$ ✗	b $2^3 = 6$ ✗	c $1^2 = 2$ ✗
d $3^2 + 4^2 = 49$ ✗	e $(-3)^2 = -9$ ✗	f $(-2)^3 = 8$ ✗

3 Which cards match each other? (Some of the cards will be left over.)

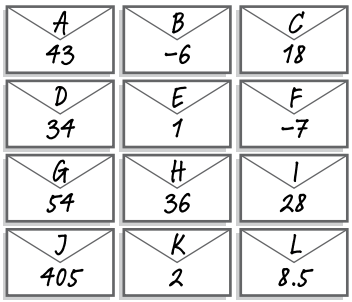


explanation 2a explanation 2b online

4 $R = 3$, $S = 2$ and $T = -4$. Find the value of each expression.

a R^2	**b** $10R^2$	**c** $1 + R^3$	**d** $5 + 3S^3$
e $R^3 - 4S^3$	**f** T^3	**g** $2T^2$	**h** S^2T^3

5 $a = 3$, $b = 4$ and $c = 10$. Which envelope contains the value of each expression?



a $2(a + b - c)$ **b** a^2b **c** $10 - a^2$

d $5(c - 1)^2$ **e** $2ab + c$ **f** $a(b^2 - c)$

g $a^2 - b^2$ **h** $\dfrac{b + c}{a + b}$ **i** $(a - 1)(b - 1)(c - 1)$

j $\dfrac{a + b + c}{2}$ **k** $3 + bc$

6 One envelope in question **5** was not used.
Make up three different expressions that could go inside this envelope.

7 $u = 4$, $v = 2$ and $w = -3$. Find the value of each expression.

a $u + w$ **b** $u - w$ **c** $u^2 + 6v^2$

d $u^3 + v^3$ **e** uv^3 **f** $2(v - w)^2$

g $5wv^2$ **h** $2w^3$ **i** $7 - 2vw$

j $(u + 2w)^3$ **k** $(v^3 - w^2)(2u + v)$ **l** $(v + w)(u + v)^2$

8 $p = 5$, $q = 6$ and $r = -2$. Find the value of each expression.

a $5p - 2q$ **b** $2p + 3r$ **c** $2q^2 + 5r^2$

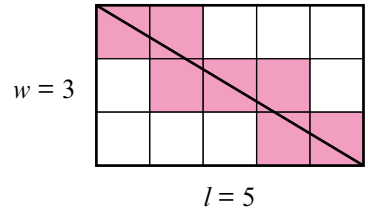
d $8p^2 + 1$ **e** $\dfrac{26 + r^3}{p + q + r}$ **f** $4r^3 + 7$

g $2p^2 - 3r$ **h** $10q^2 - 7$ **i** $2p^3 - 6p$

explanation 3a explanation 3b

9 A rectangle has length l and width w.
This is the formula for c, the number of squares that are cut by a diagonal of the rectangle.

$c = l + w -$ (HCF of l and w)



a Paul checks the formula on a 5 by 3 rectangle. He shades the squares that have been cut by the diagonal and counts them. The answer is $c = 7$.
Does the formula give the same answer?

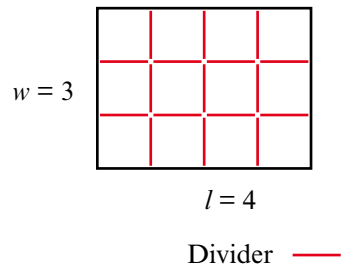
b Draw rectangles for these values of l and w.
Count the number of squares that are cut by the diagonal.
Then check whether the formula gives the same answer.

i $l = 7, w = 2$ **ii** $l = 10, w = 4$ **iii** $l = 8, w = 4$

10 This rectangle is 3 units wide and 4 units long.
It has 17 red dividers.

Arjun says that this formula gives the number of dividers, d, needed by a rectangle of length l and width w.

$d = (w - 1)l + (l - 1)w$



a Does the formula work for this rectangle?

b Check whether the formula works for the following rectangles.
Draw diagrams to show your working.

i $l = 5, w = 3$ **ii** $l = 6, w = 2$ **iii** $l = 7, w = 1$

11 **a** The sum of the first n square numbers is S. Copy and complete the table.

n	1	2	3	4	5
S	1	$1 + 4 = 5$	$1 + 4 + 9 = \square$	$1 + 4 + 9 + 16 = \square$	$1 + 4 + 9 + 16 + 25 = \square$

b Here are three possible formulae for S. Only one is correct.

Which is the correct formula? Show how you decided.

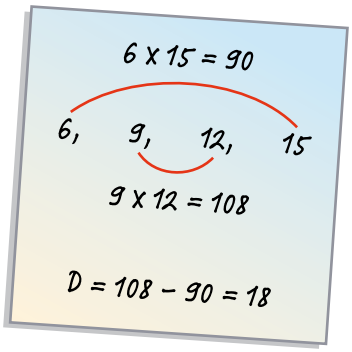
i $S = 4n - 3$ **ii** $S = \frac{5n^2 - 7n + 4}{2}$ **iii** $S = \frac{n(n + 1)(2n + 1)}{6}$

12 Brian writes four consecutive multiples of 3.

He multiplies the largest and smallest numbers together.

He subtracts this from the product of the middle two numbers.

The difference is $D = 108 - 90 = 18$



a Write another four consecutive multiples of 3 and find the difference D. Is the difference always 18?

b What is the difference, D, for four consecutive multiples of 2?

c Find the difference, D, for any four consecutive multiples of 4.

d What is D for any four consecutive multiples of 1?

e Copy and complete the table.
m represents the multiple and D the difference.

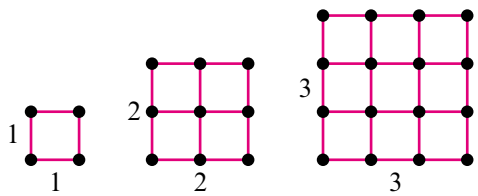
Multiple (m)	1	2	3	4	5	6
Difference (D)			18			

f Complete the formula. $D = 2 \times m^{\square}$

g Find D for these values of m.

i 7 **ii** 9 **iii** 10

13 Sally uses 12 red connectors to make a square of side length 2 units.



a Draw the next two squares. Copy and complete the table.

Side length of square (s)	1 unit	2 units	3 units	4 units	5 units
Number of connectors (c)	4	12			

b Copy and complete this formula. $c = \square\, s(s + 1)$

c Use your formula to find the number of connectors when $s = 8$.

d Sally has 200 connectors. What is the largest square she can make?

14 The diagram shows squares of side length 2 units and of side length 3 units.

To find T, multiply the numbers in opposite corners of the square, then add the products.

1	2
3	4

1	2	3
4	5	6
7	8	9

a Draw a similar square that has side length 4 units.

b For the square of side length 2 units, $T = (3 \times 2) + (1 \times 4) = 6 + 4 = 10$

For the square of side length 3 units, $T = (7 \times 3) + (1 \times 9) = 21 + 9 = 30$

Find T for the square of side length 4 units.

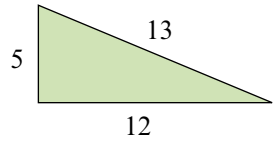
c n is the side length of a square. Check whether $T = n^3 + n$ is the correct formula for T by finding the value of T when $n = 2$, 3, and 4.

15 This is the formula for the area of a triangle.

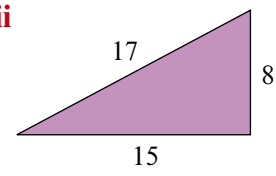
$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$

a Use the formula to find the areas of these triangles.

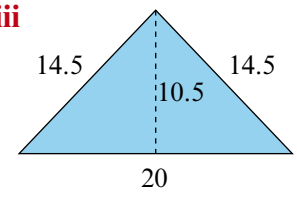
i



ii



iii



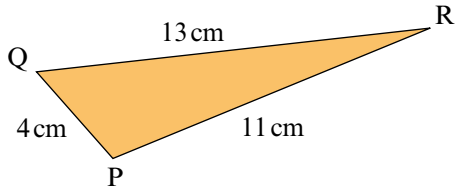
b The letters a, b, and c stand for the length of each side of a triangle.

$s = \frac{a + b + c}{2}$ $\qquad T = \sqrt{s(s-a)(s-b)(s-c)}$

For each triangle in part **a**, find the values of s and T.

c What does the formula for T give?

16 Explain how to find the area of the triangle PQR.
Find the area of the triangle to the nearest square centimetre.



Use your answer to question **15c**.