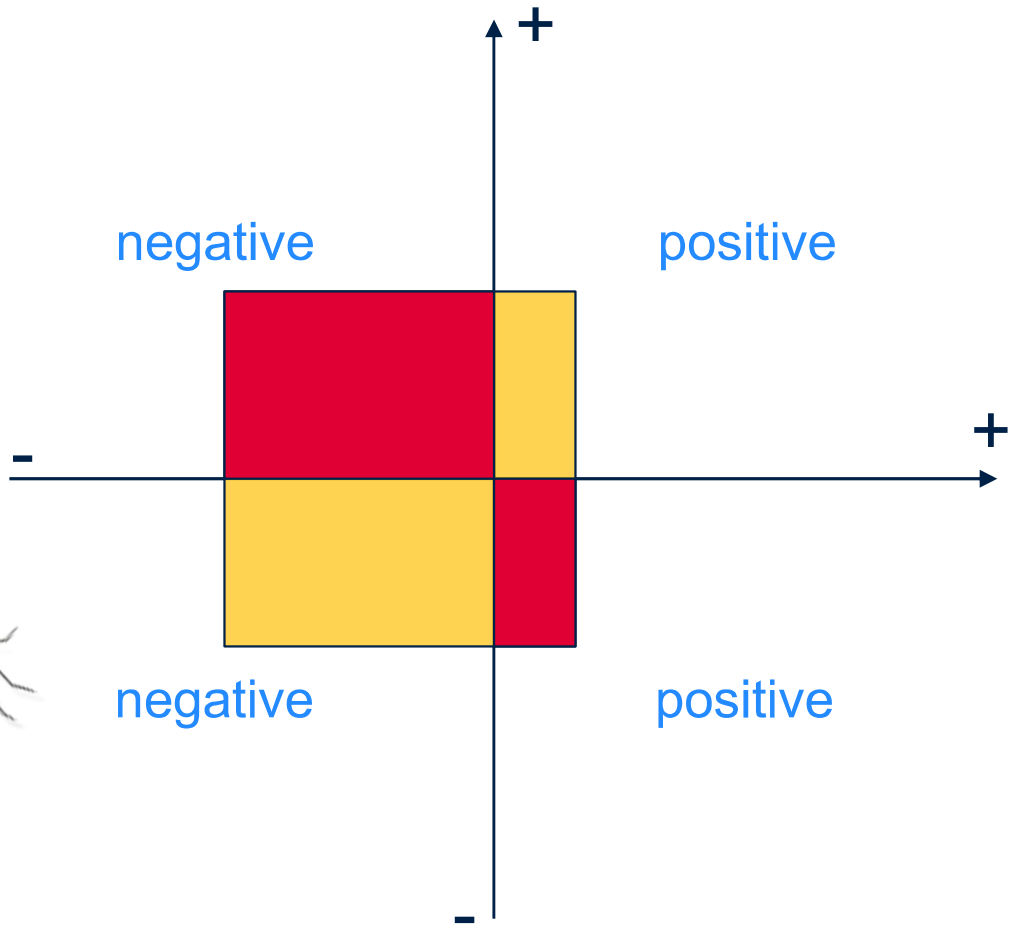
Did you know ?

We use a 2D co-ordinate plane to develop understanding regarding multiplication and also a *lot* of algebra.

It was developed by Rene Descarte, in 1637, when he lay in his sick bed - watching ants crawl across a tiled ceiling!



The Ancient Greeks did not have the notion of a co-ordinate plane but they used similar geometric methods to develop very sophisticated algebra over 2500 years ago!

How can the diagram help us understand what happens when you multiply with negative numbers?

Dealing with Negativity

Try these quick questions

1. $4 \times (-7) \times 6$
2. $3 \times 9 \times (-6)$
3. $2 \times (-3) \times (-4)$
4. $2 \times (-2) \times (-2) \times (-5)$
5. $a \times 7 \times a$
6. $ab \times 3 \times 6b$
7. $(-4a) \times 7a \times (-6a)$

What do you notice about your answers?

8. Use what you have noticed to fill in the gaps in the sentences below

positive | EVEN | negative | ODD

With an …….. number of negative numbers then value will be …….

With an …….. number of negative numbers then value will be …….

Dealing with Negativity

Solutions on the next slide….

Dealing with Negativity

Try these quick questions

What do you notice about your answers?

1. $4 \times (-7) \times 6 = -168$
2. $3 \times 9 \times (-6) = -162$
3. $2 \times (-3) \times (-4) = 24$
4. $2 \times (-2) \times (-2) \times (-5) = -40$
5. $(-a) \times (-7) \times a = 7a^2$
6. $ab \times 3 \times 6b = 18ab^2$
7. $(-4a) \times 7a \times (-6a) = 168a^3$

8. Use what you have noticed to fill in the gaps in the sentences below

With an EVEN number of negative numbers then value will be positive

With an ODD number of negative numbers then value will be negative

Unsure about any of these? Search Negative numbers

Expanding 1

1. Without doing the calculation, will the answer to this calculation be positive or negative ? Give a reason.

$2 \times (-3) \times (-4) \times 6 \times (-6) \times (-1) \times 7 \times (-2)$

2. 24×17 is the same as which of the following

$2 \times 3 \times 17 \times 2 \times 2$	$(20 + 4)(10 + 7)$
$(30 - 5)(20 - 2)$	$20(10 + 7) + 4(10 + 7)$

3. Expand $3(\sqrt{3} - 6)$

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

5. Expand and simplify $(x + 6)(x - 2)$

6. Expand and simplify $(\sqrt{2} + 3)(\sqrt{2} + 1)$

7. Expand and simplify $(x^2 + 2)(x^2 + 6)$

8. Expand and simplify $(x^2 + 3)(x^3 + 7)$

Expanding 1

Solutions on the next slide….

Expanding 1 Solutions

1. Without doing the calculation, will the answer to this calculation be positive or negative ? Give a reason.

$2 \times (-3) \times (-4) \times 6 \times (-6) \times (-1) \times 7 \times (-2)$

→ Negative because there are an odd number of negative numbers

2. 24×17 is the same as which of the following

$2 \times 3 \times 17 \times 2 \times 2$	$(20 + 4)(10 + 7)$
$(30 - 5)(20 - 2)$	$20(10 + 7) + 4(10 + 7)$

→

$2 \times 3 \times 17 \times 2 \times 2$	$(20 + 4)(10 + 7)$
$(30 - 5)(20 - 2)$	$20(10 + 7) + 4(10 + 7)$

3. Expand $3(\sqrt{3} - 6)$

→ $= 3\sqrt{3} - 18$

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

→ $= x^2 + 2x + 5x + 10$
$= x^2 + 7x + 10$

Unsure about any of these? Search Expanding single brackets

Expanding 1 Solutions

5. Expand and simplify $(x+6)(x-2)$ → $= x^2 + 6x - 2x - 12$
$= x^2 + 4x - 12$

6. Expand and simplify $(\sqrt{2}+3)(\sqrt{2}+1)$ → $= 2 + 3\sqrt{2} + \sqrt{2} + 3$
$= 4\sqrt{2} + 5$

7. Expand and simplify $(x^2+2)(x^2+6)$ → $= x^4 + 2x^2 + 6x^2 + 12$
$= x^4 + 8x^2 + 12$

8. Expand and simplify $(x^2+3)(x^3+7)$ → $= x^5 + 3x^3 + 7x^2 + 21$

Unsure about any of these? Search Expanding Double Brackets

Expanding 2

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

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

3. Expand and simplify $(x + 6)^2 + (x - 3)^2$

4. Expand and simplify $\left(2 - \sqrt{3}\right)^2$

5. Simplify $\frac{2}{(x+3)} + \frac{x-3}{x}$

6. Expand and simplify $(x^3 - 7)(x^3 + 7)$

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

8. Simplify $\frac{2x-2}{(x+2)} - \frac{x-2}{3x}$

Expanding 2

Solutions on the next slide….

Expanding 2 Solutions

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

$= 2x^2 + 3x - 4x - 6$
$= 2x^2 - x - 6$

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

$= 3x^2 + 9x + 4x + 12$
$= 3x^2 + 13x + 12$

3. Expand and simplify $(x + 6)^2 + (x - 3)^2$

$= (x + 6)(x + 6) + (x - 3)(x - 3)$
$= x^2 + 12x + 36 + x^2 - 6x + 9$
$= 2x^2 + 6x + 45$

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

$= (2 - \sqrt{3})(2 - \sqrt{3})$
$= 4 - 2\sqrt{3} - 2\sqrt{3} + 3$
$= 7 - 4\sqrt{3}$

Expanding 2 Solutions

5. Simplify $\frac{2}{(x+3)}+\frac{x-3}{x}$

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

$$= \frac{2x}{x(x+3)}+\frac{x^2-9}{x(x+3)} \rightarrow \frac{x^2+2x-9}{x(x+3)}$$

6. Expand and simplify $(x^3-7)(x^3+7)$

$$= x^6-7x^3+7x^3-49$$
$$= x^6-49$$

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

$$= 3x(4x^2+2x-3)+2(4x^2+2x-3)$$
$$= 12x^3+6x^2-9x+8x^2+4x-6$$
$$= 12x^3+14x^2-5x-6$$

8. Simplify $\frac{2x-2}{(x+2)}-\frac{x-2}{3x}$

$$= \frac{3x(2x-2)}{3x(x+2)}-\frac{(x-2)(x+2)}{3x(x+2)} \rightarrow \frac{6x^2-6x}{3x(x+2)}-\frac{x^2-4}{3x(x+2)}$$

$$= \frac{5x^2-6x+4}{3x(x+2)}$$