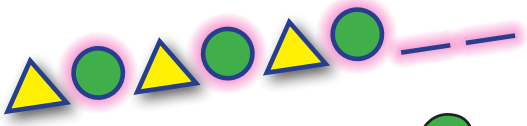
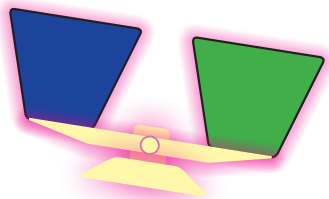
Sense of Number

Visual Algebra Policy

St. Luke's C. of E. Primary School

October 2015





Graphic Design by Dave Godfrey

Compiled by the Sense of Number Maths Team

For sole use within St. Luke's C. of E. Primary School.

'A picture is worth 1000 words!'

www.senseofnumber.co.uk

Guide to using a Visual Algebra Policy

The Sense of Number Visual Algebra Policy provides a visual interpretation of the progression required across the Primary school to help children meet the objectives found within Domain 10: Algebra in the new National Curriculum.

A school branded VAP is created by Dave Godfrey for individual schools when the school logo and school name are added to the footer of each slide.

Typical uses:

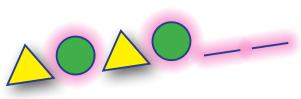
Classroom: The slides are printed out (e.g. A4) and the appropriate slides are displayed within each classroom for continual reference or on a working wall.

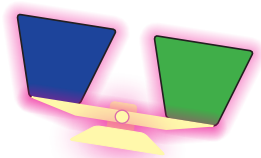
Teacher Reference: The slides are printed out (e.g. 9 slides per A4 page) and inserted in the teacher's planning folder.

Parents: The slides are used to communicate to parents the school's approach to developing and teaching algebraic thinking.

Website: Selected slides from the VAP are inserted onto a school's maths webpages. (Please note: the VAP should not be made available for download.)

Sections in the Visual Algebra Policy





Pages	Code	Years	Theme
9-14	AA	FS-Y4	Patterns and Sequences
15-23	AB	Y1-Y6	Counting Sequences
24-31	AC	Y1-Y6	Number Shapes (patterns & sequences)
32-37	AD	Y1-Y6	Abacus (patterns & sequences)
38-56	AE	Y1-Y6	Function Machines
57-69	AF	Y4-Y6	Graphing Sequences
70-73	AG	Y1-Y4	Balancing Stacks
74-91	AH	Y1-Y6	Balancing Equations
92-97	AI	Y4-Y6	Formulae
98-102	AJ	Y5-Y6	Algebra Word Problems

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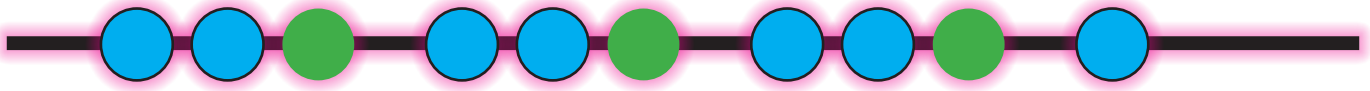
Year Groups:

Specific Slide Locations

Section	Y1	Y2	Y3	Y4	Y5	Y6
A: Patterns and Sequences	9-11	11-14				
B: Counting Sequences	15-16	17-18		19-21	20-23	
C: Number Shapes (P&S)	24	25	26,27		28-31	
D: Abacus (P&S)	32		33-35		36,37	
E: Function Machines	38	39-43	44-47	48-51	52	53-56
F: Graphing Sequences				57,58	59-63	61-69
G: Balancing Stacks	70	70,71	72	73		
H: Balancing Equations	74-76	77,78	79	79,80	81-83	84-91
I: Formulae				92-94	95-97	
J: Algebra Word Problems					98-102	

Seeing a Sequence

A: Count



B: Pattern

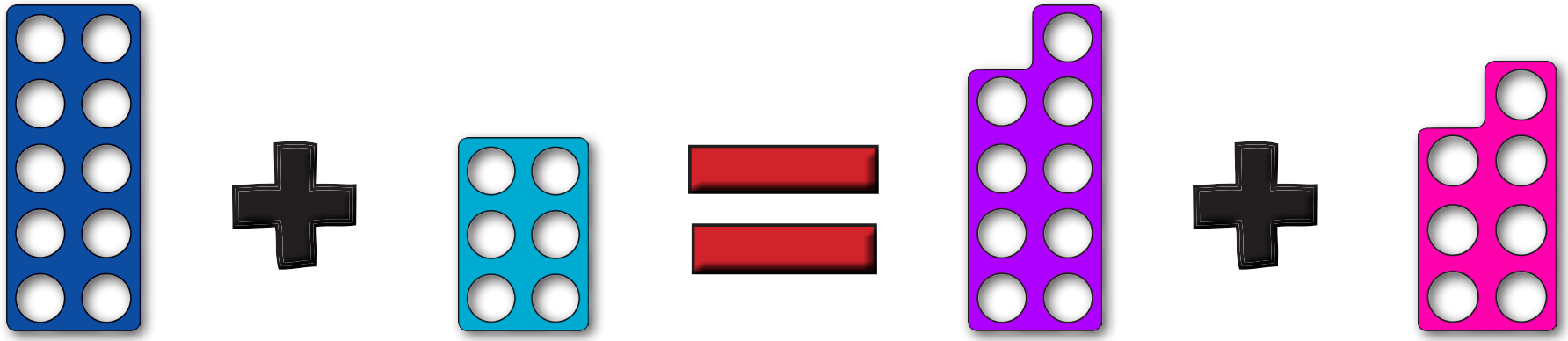
BBG BBG BBG B

C: Terms of Sequence

labelling the position of the greens

term			1			2			3			
count	1	2	3	4	5	6	7	8	9	10		
y			3			6			9			

Equals Sign is a Balance



"The equals sign is a balance"

Algebraic Notation

$d + d$

$d \times 2$

$2d$

$d \div 2$

$\frac{d}{2}$

$d - 2$

$d - 2$

$2 - d$

$2 - d$

$d \times d$

d^2

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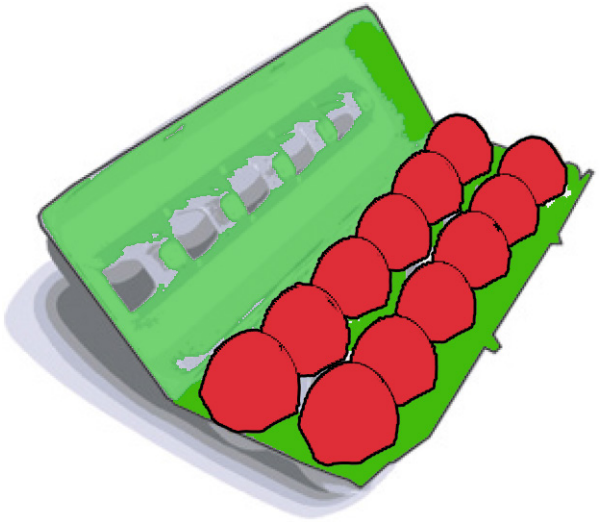
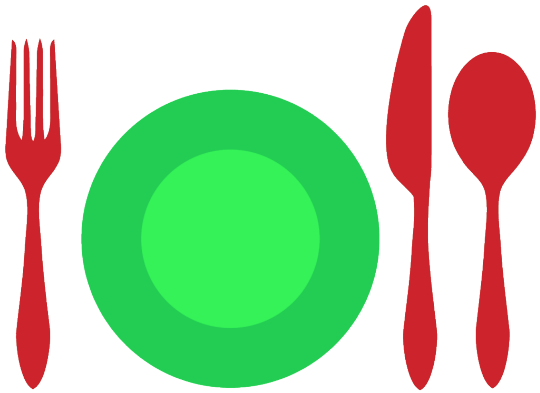
Letters in Algebra



$e = 12b$

Number of Eggs	e	12	24	36	$12b$
Number of Full Boxes	b	1	2	3	$\frac{e}{12}$



$c = 3p$

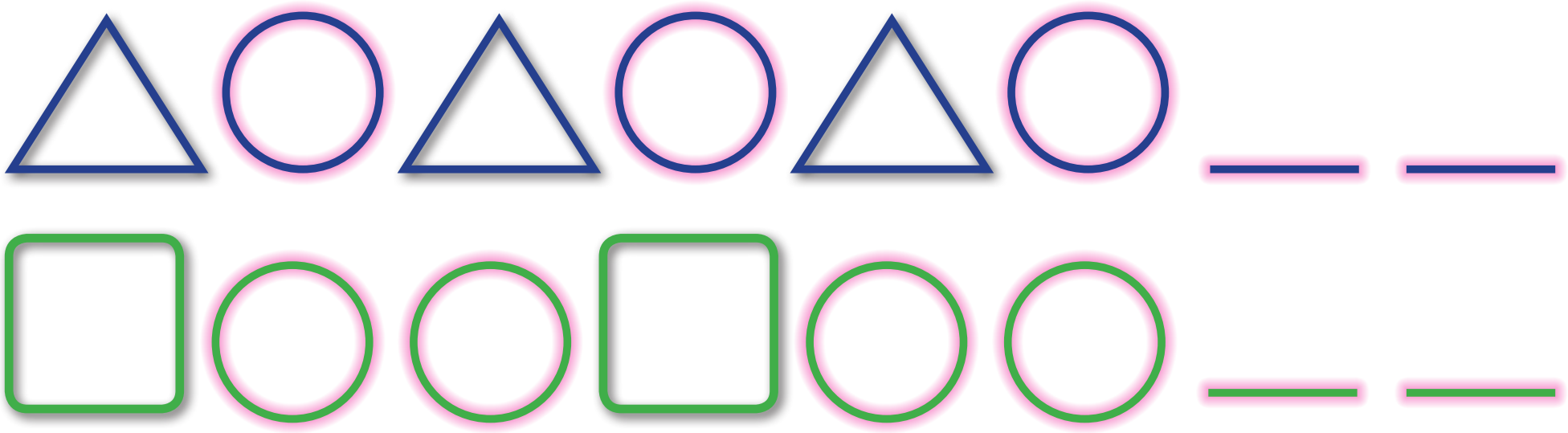
Number of pieces of cutlery	c	3	6	9	$3p$
Number of place settings	p	1	2	3	$\frac{c}{3}$

In Algebra letters are variables!

AA: Patterns & Sequences

FS/1

What are the missing terms?



1, 2, 3, __, 5, __, 7, 8,

10, 20, __, 40, 50, __,

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AA: Patterns & Sequences

1

What are the missing terms?

2, 4, 6, __, __, 12, 14,

5, 10, 15, 20, __, __, 45,

24, 22, __, 18, 16, __,

30, 40, __, 60, 70, __,

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AA: Patterns & Sequences

2a

What are the missing terms?

1, __, __, 4, __, __, 7, __,

37, 39, __, 43, 45, __,

180, 170, __, 150, 140, __,

AA: Patterns & Sequences

2b

What are the missing terms?

1, 4, __, __, 13, 16, __, __,

5, 9, ___, 17, ___, 25,

36, 42, ___, 54, 60, ___,

AA: Patterns & Sequences

3

What are the missing terms?

1, 4, 9, __, __, 36, 49,

3, 6, 10, 15, __, __,

1, 5, 9, 13, __, __, __, __,

AA: Patterns & Sequences

3/4

What are the missing terms?

12, 8, 4, 0, ___, ___, -12,

5, 3, 1, ___, ___, -5, -7,

32, 22, 12, 2, ___, ___,

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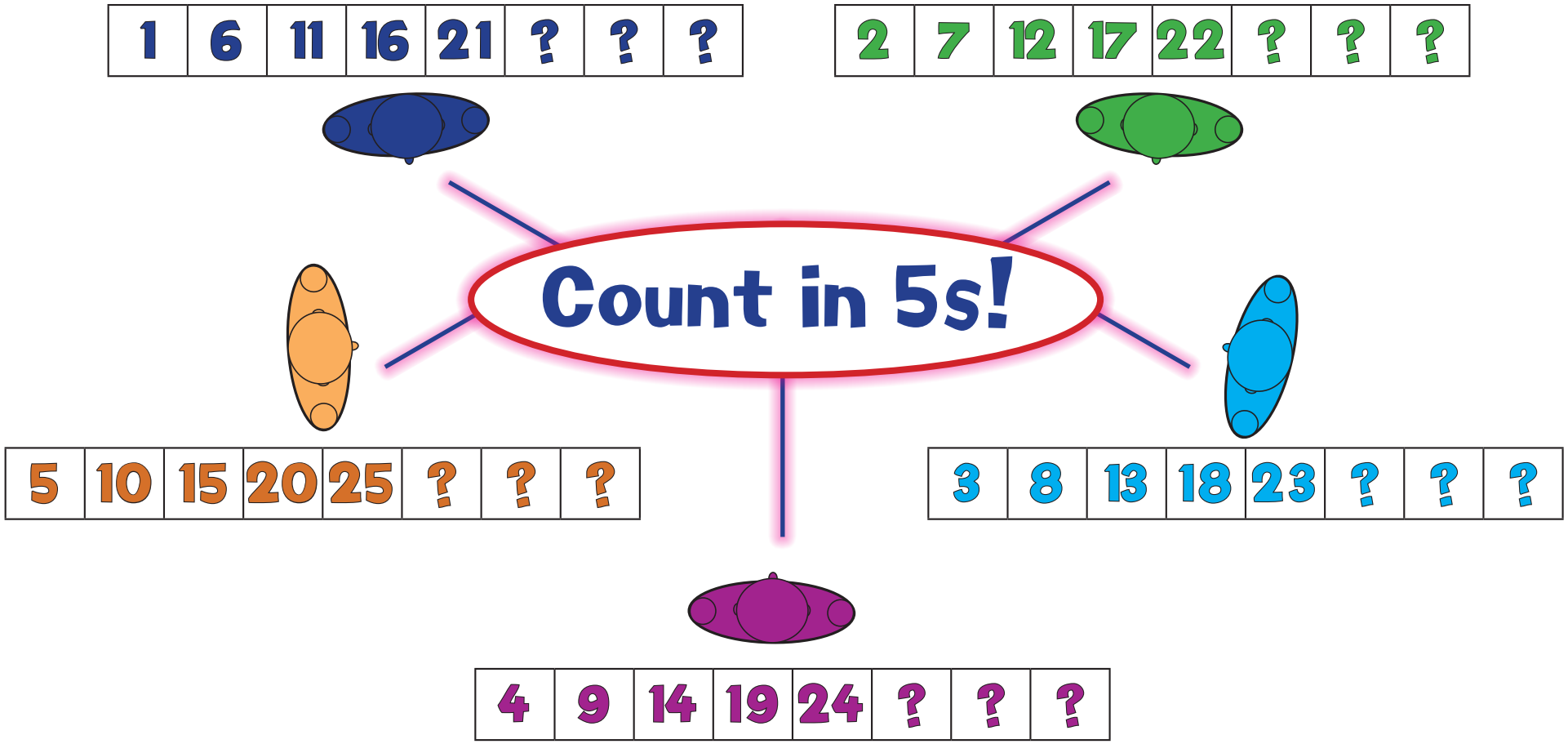
AB: Counting Sequences

1/2a

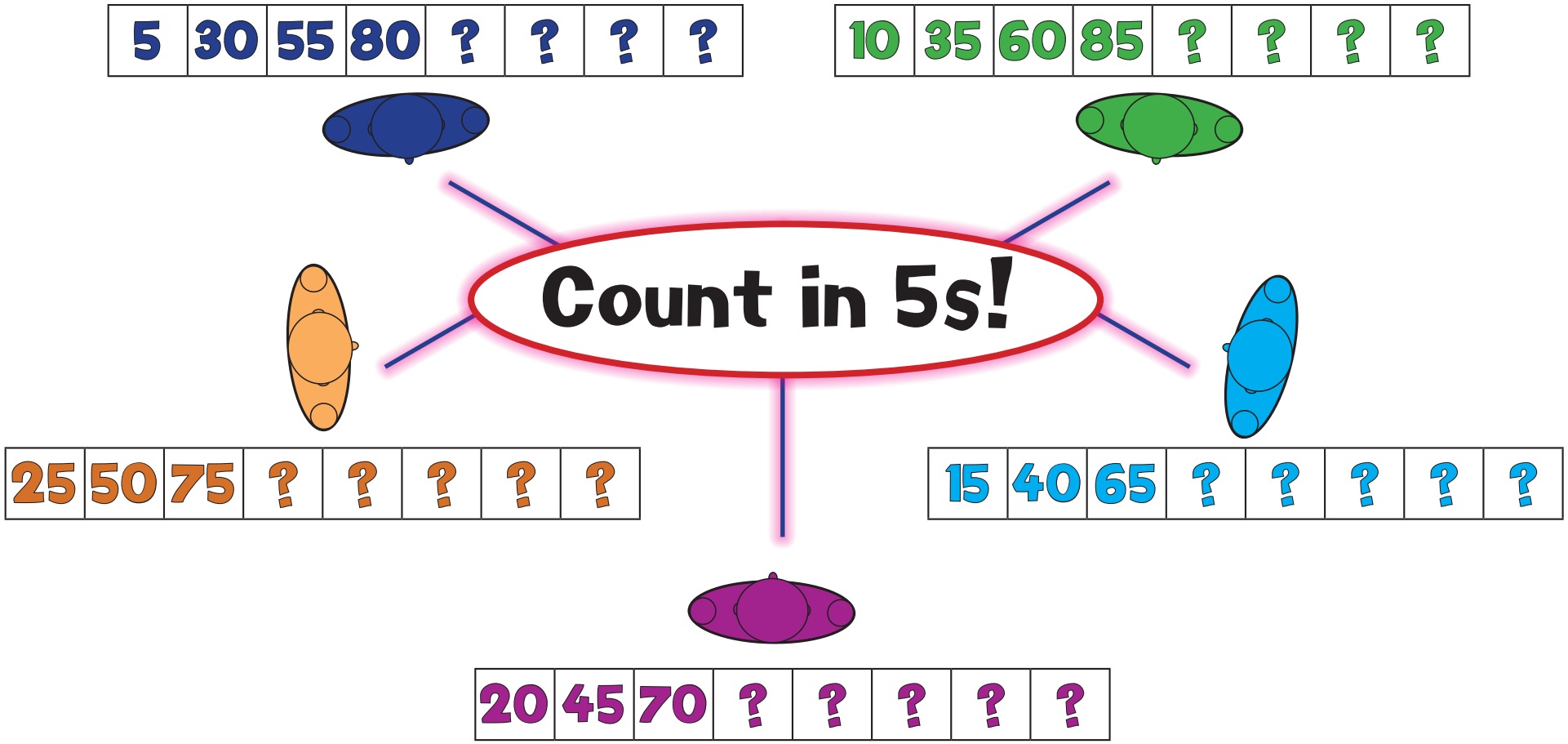
"Who is going to say 30?"



AB: Counting Sequences

1/2b

"Who is going to say 100?"

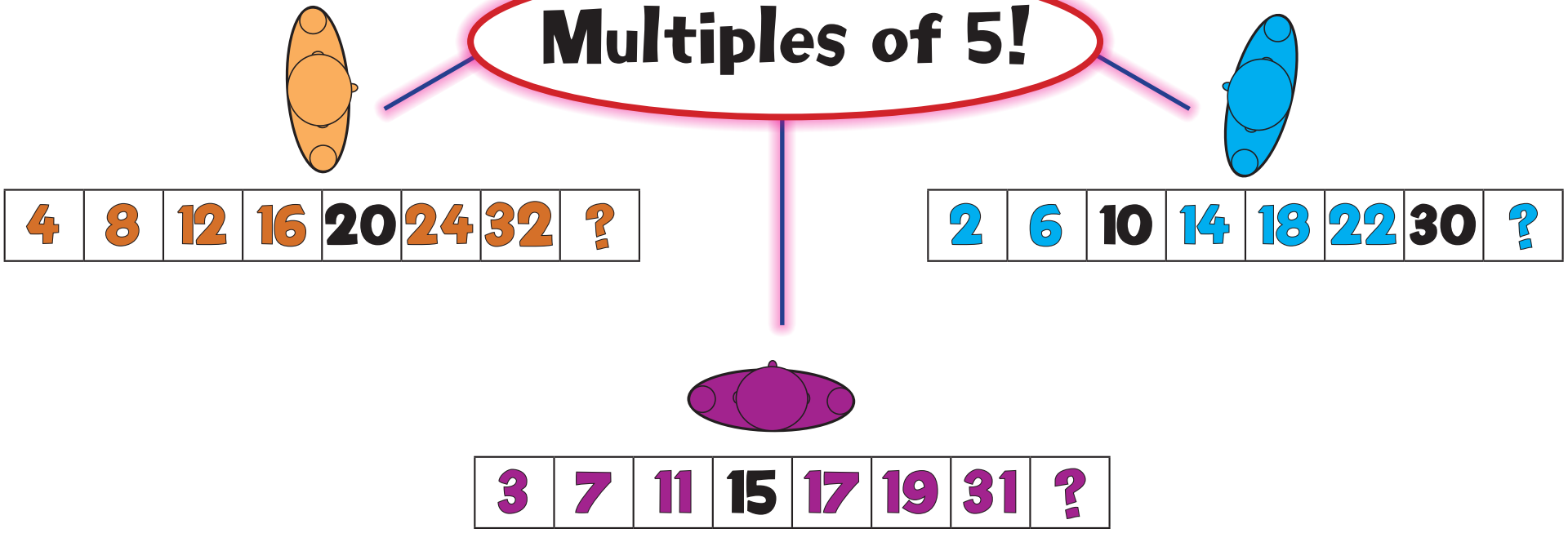


AB: Counting Sequences

2/3a

"Who is going to say 35?"

1	5	9	13	17	21	25	?



AB: Counting Sequences

2/3b

"Who is going to say 39?"

1	5	9	13	17	21	?	?

Count in 4s!

4	8	12	16	20	24	?	?

Counting in 4s

2	6	10	14	18	22	?	?

2 less than counting in 4s

3	7	11	15	17	19	?	?

1 less than counting in 4s

AB: Counting Sequences

3/4

"Who is going to say 60?"

1	5	9	13	17	21	?	?

Multiples of 6!

4	8	12	16	20	24	?	?

2	6	10	14	18	22	?	?

3	7	11	15	17	19	?	?

AB: Counting Sequences

4/5a

"Who is going to say 70?"

1	5	9	13	17	21	?	?

Multiples of 7!

4	8	12	16	20	24	28	?

2	6	10	14	18	22	?	?

3	7	11	15	17	19	?	?

AB: Counting Sequences

4/5b

"Who is going to say 144?"

1	5	9	13	17	21	?	?

Multiples of 12!

4	8	12	16	20	24	28	?

2	6	10	14	18	22	?	?

3	7	11	15	17	19	?	?

AB: Counting Sequences

5/6

"Who is going to say 24?"

1.2	6	10.8	15.6	?

Count in 1.2s!

4.8	9.6	14.4	19.2	?

2.4	7.2	12	16.8	?

3.6	8.4	13.2	18	?

AB: $y = 4x - ?$

5/6b

"Who is going to say 39?"

$y = 4x - 3$

x	1	2	3	4	5	6	7	8
y	1	5	9	13	17	21	?	?

Count in 4s!

$y = 4x$

x	1	2	3	4	5	6	7	8
y	4	8	12	16	20	24	?	?

$y = 4x - 2$

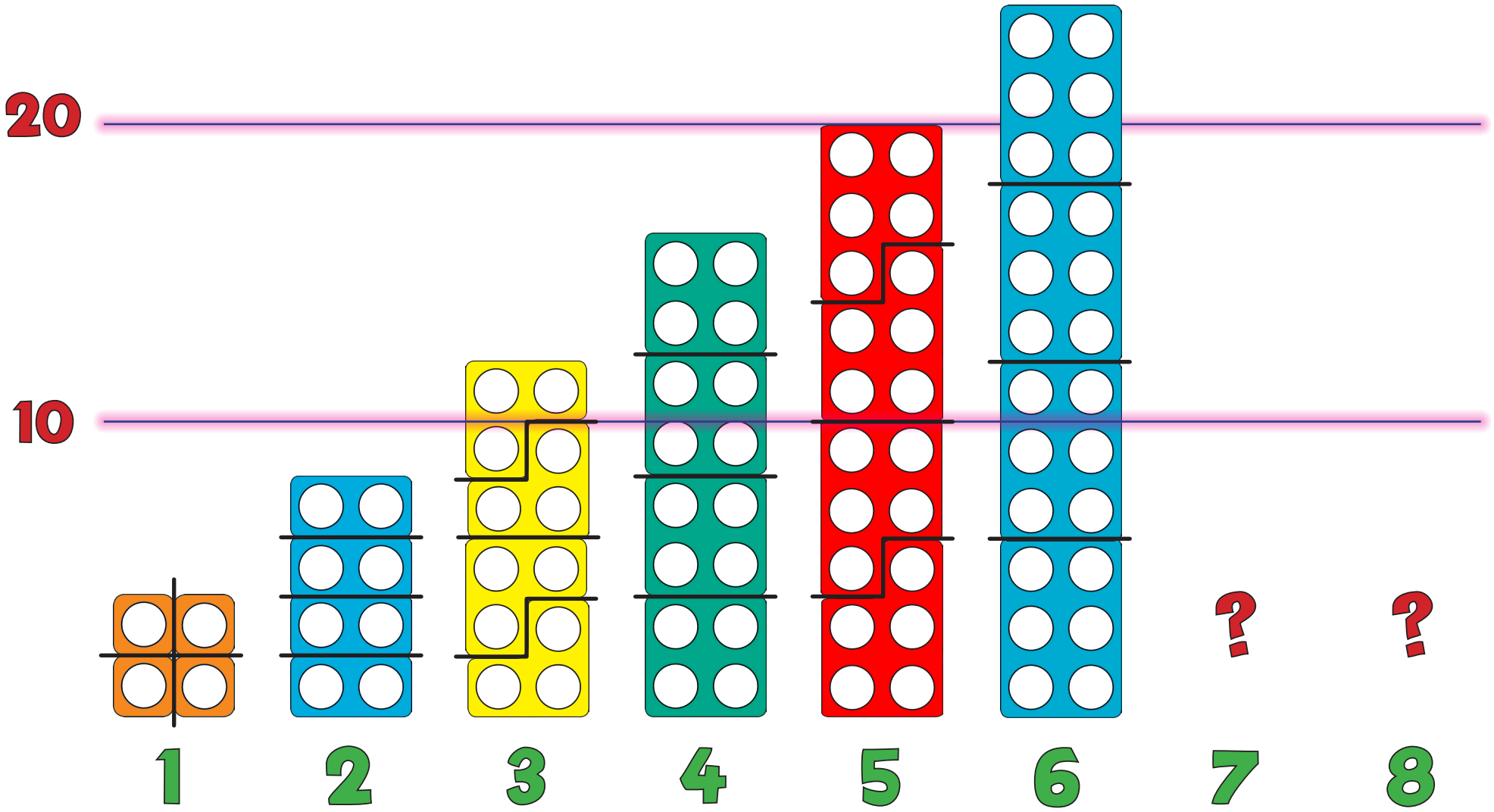
x	1	2	3	4	5	6	7	8
y	2	6	10	14	18	22	?	?

$y = 4x - 1$

x	1	2	3	4	5	6	7	8
y	3	7	11	15	17	19	?	?

AC: Number Shapes

1 Sequences



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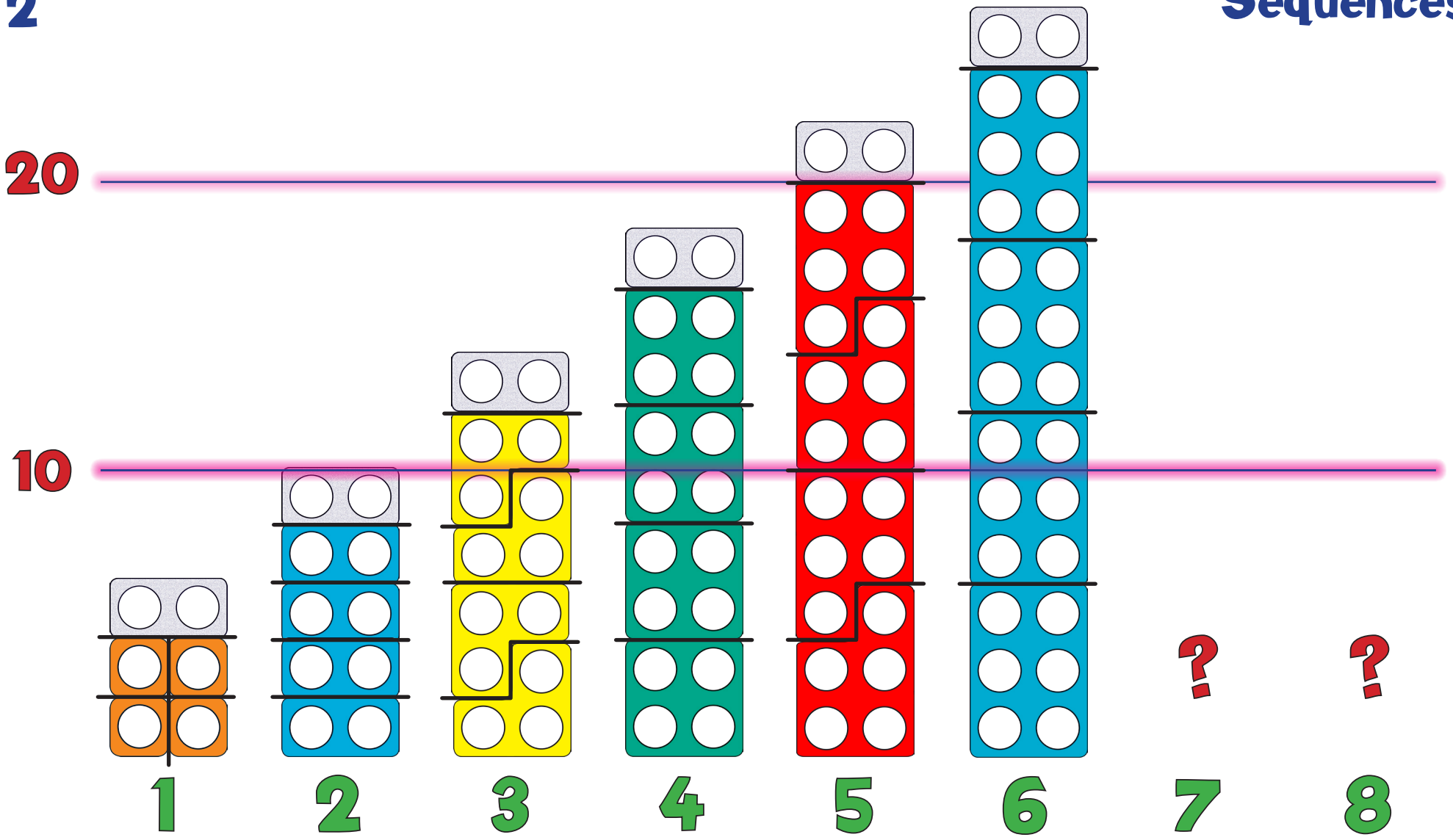
AC: Number Shapes

2 Sequences



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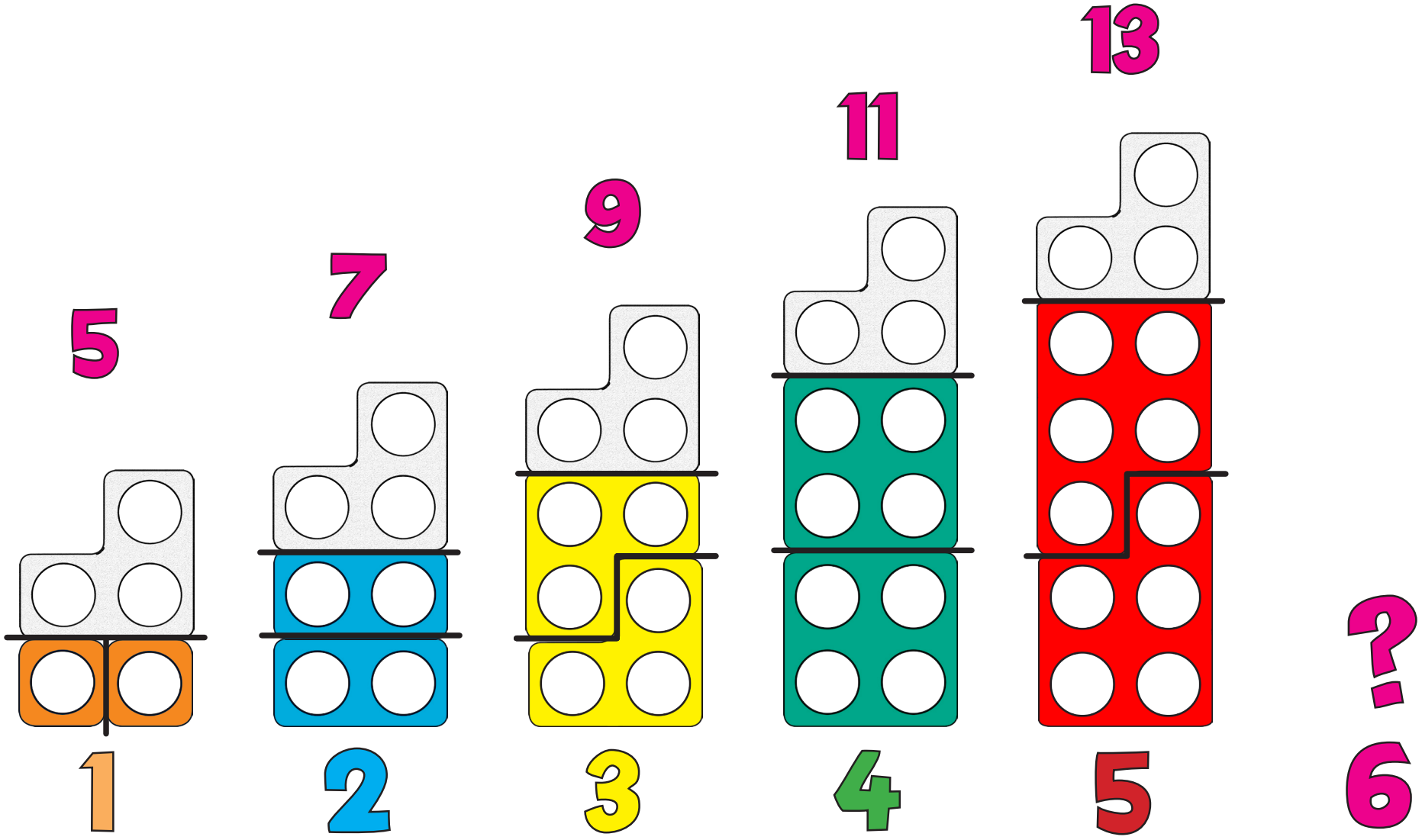
AC: Number Shapes

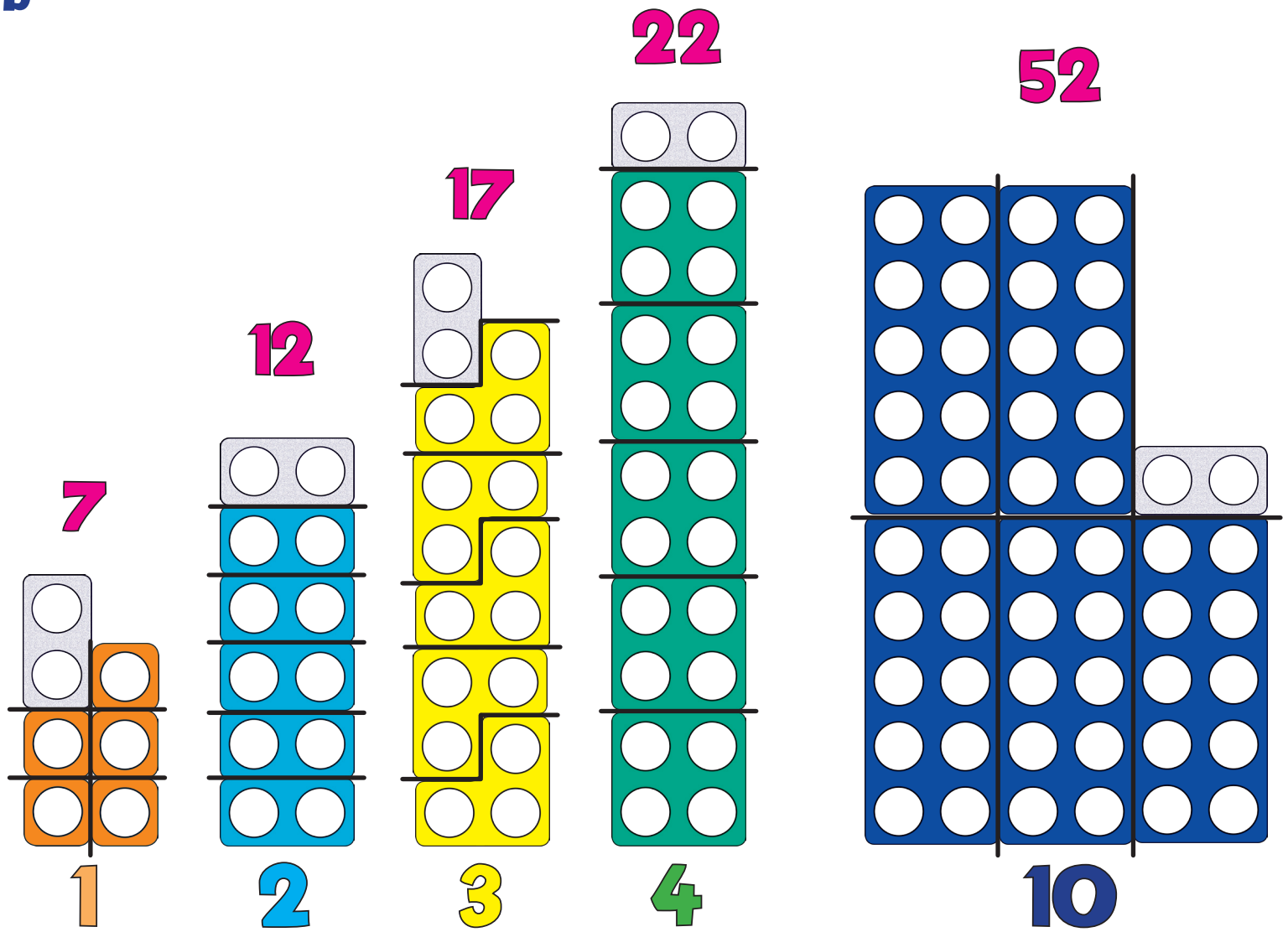
3a

Sequences



AC: Number Shapes

3b Sequences

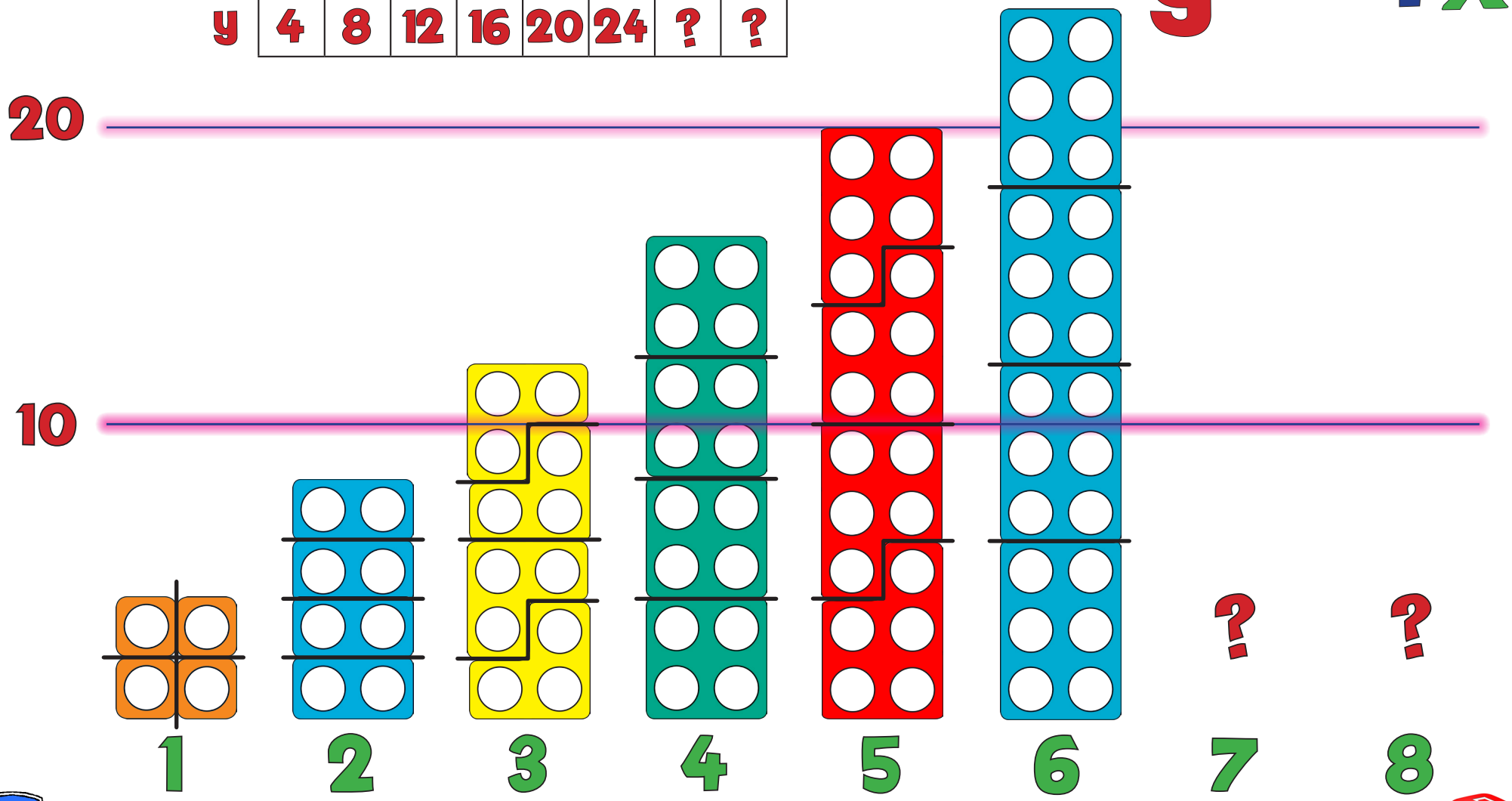


AC: Number Shapes

5/6a

x	1	2	3	4	5	6	7	8
y	4	8	12	16	20	24	?	?

$y = 4x$

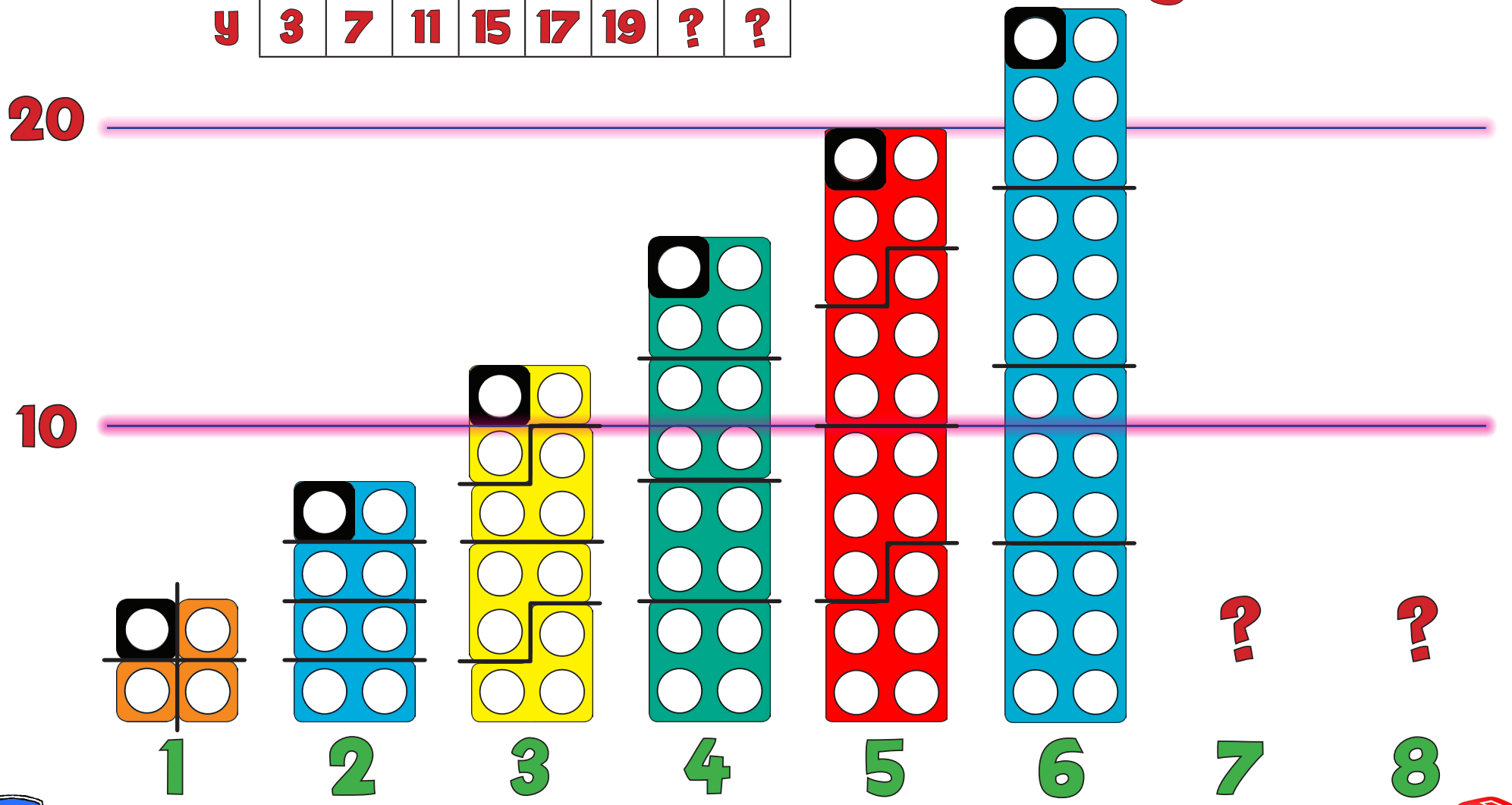


AC: Number Shapes

5/6b

x	1	2	3	4	5	6	7	8
y	3	7	11	15	17	19	?	?

$y = 4x - 1$

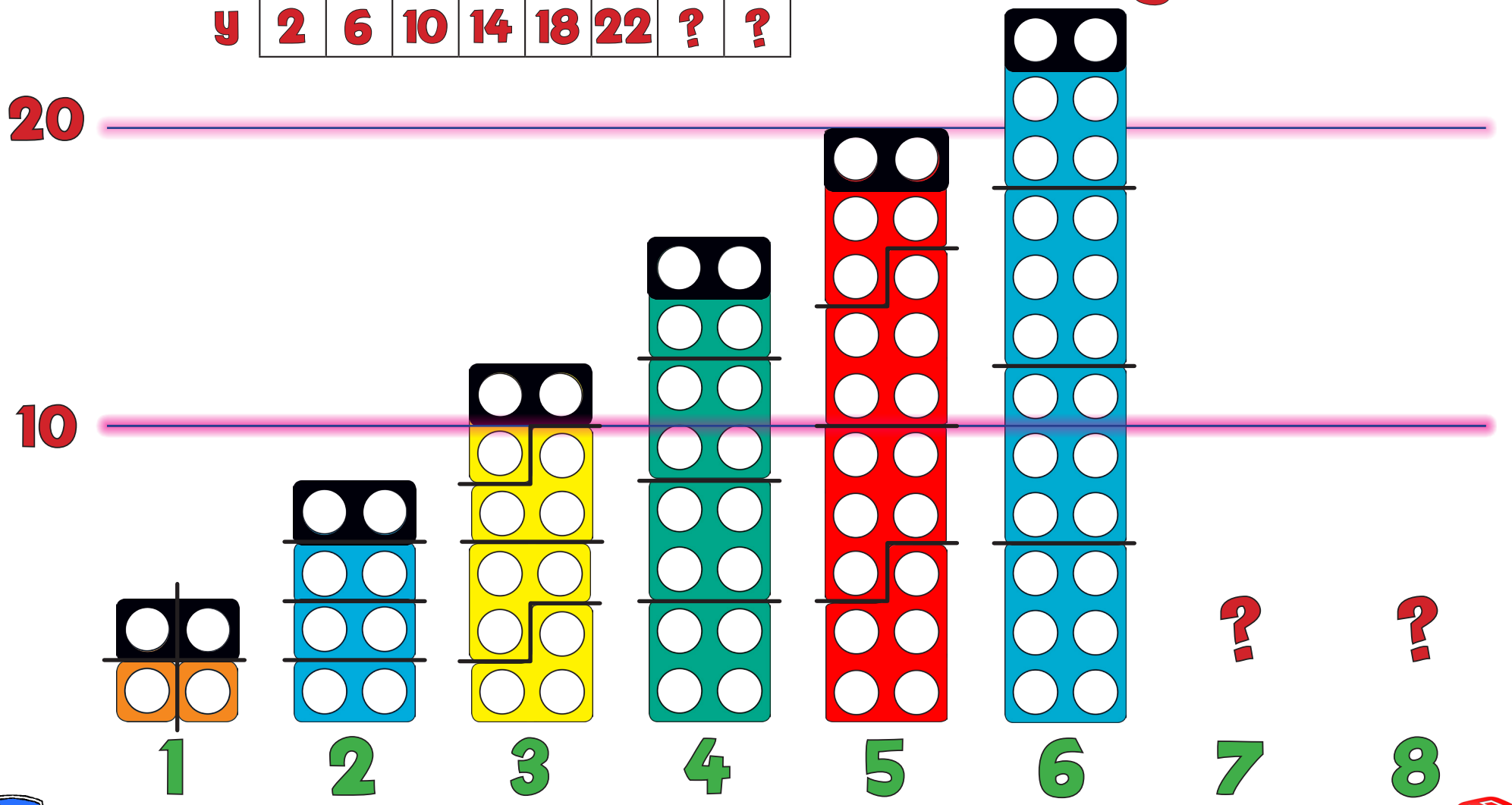


AC: Number Shapes

5/6c

x	1	2	3	4	5	6	7	8
y	2	6	10	14	18	22	?	?

$y = 4x - 2$

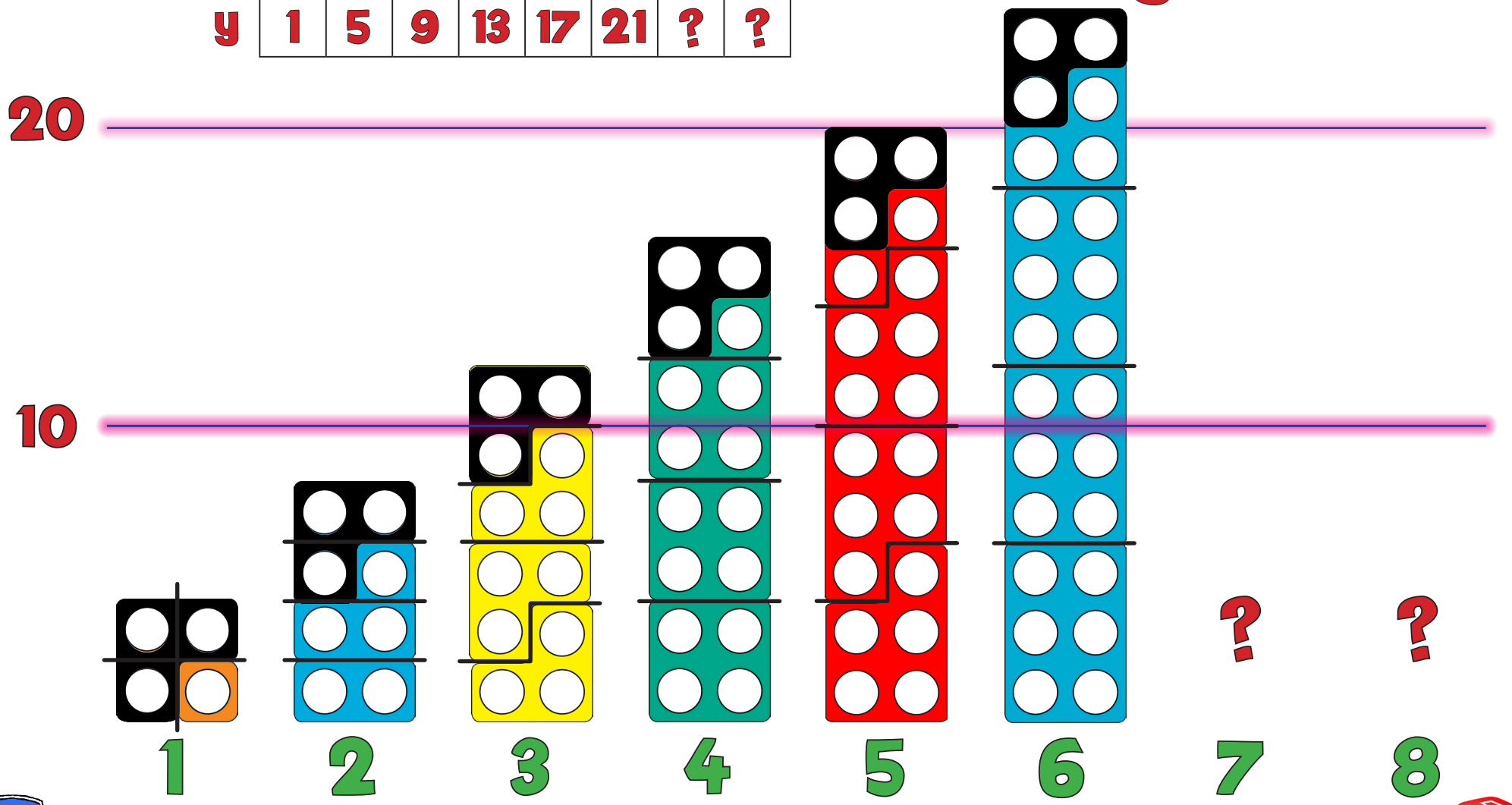


AC: Number Shapes

5/6d

x	1	2	3	4	5	6	7	8
y	1	5	9	13	17	21	?	?

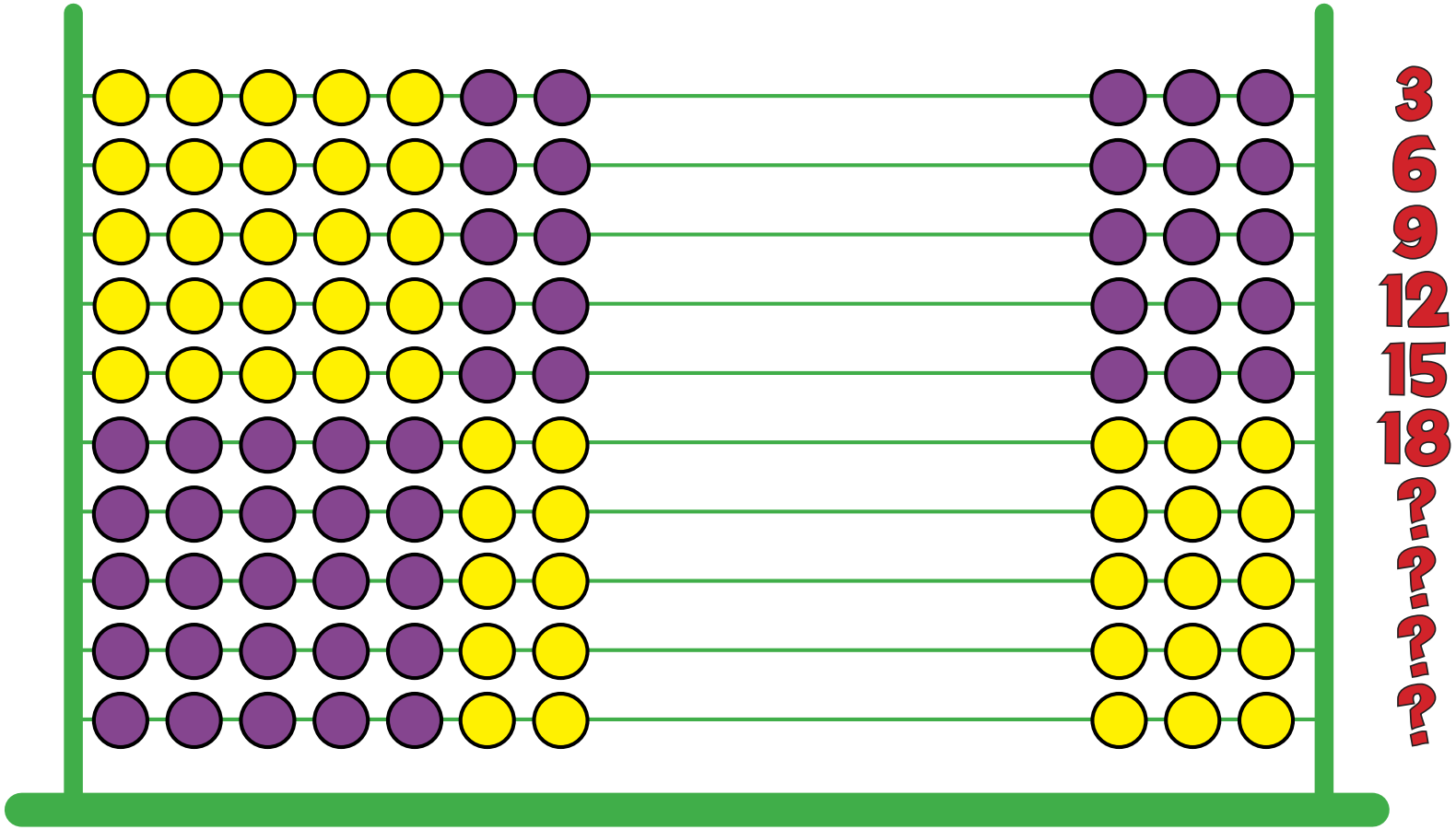
$y = 4x - 3$



AD: Abacus

1/2

1	→	3
2	→	6
3	→	9
4	→	12
5	→	15
6	→	18

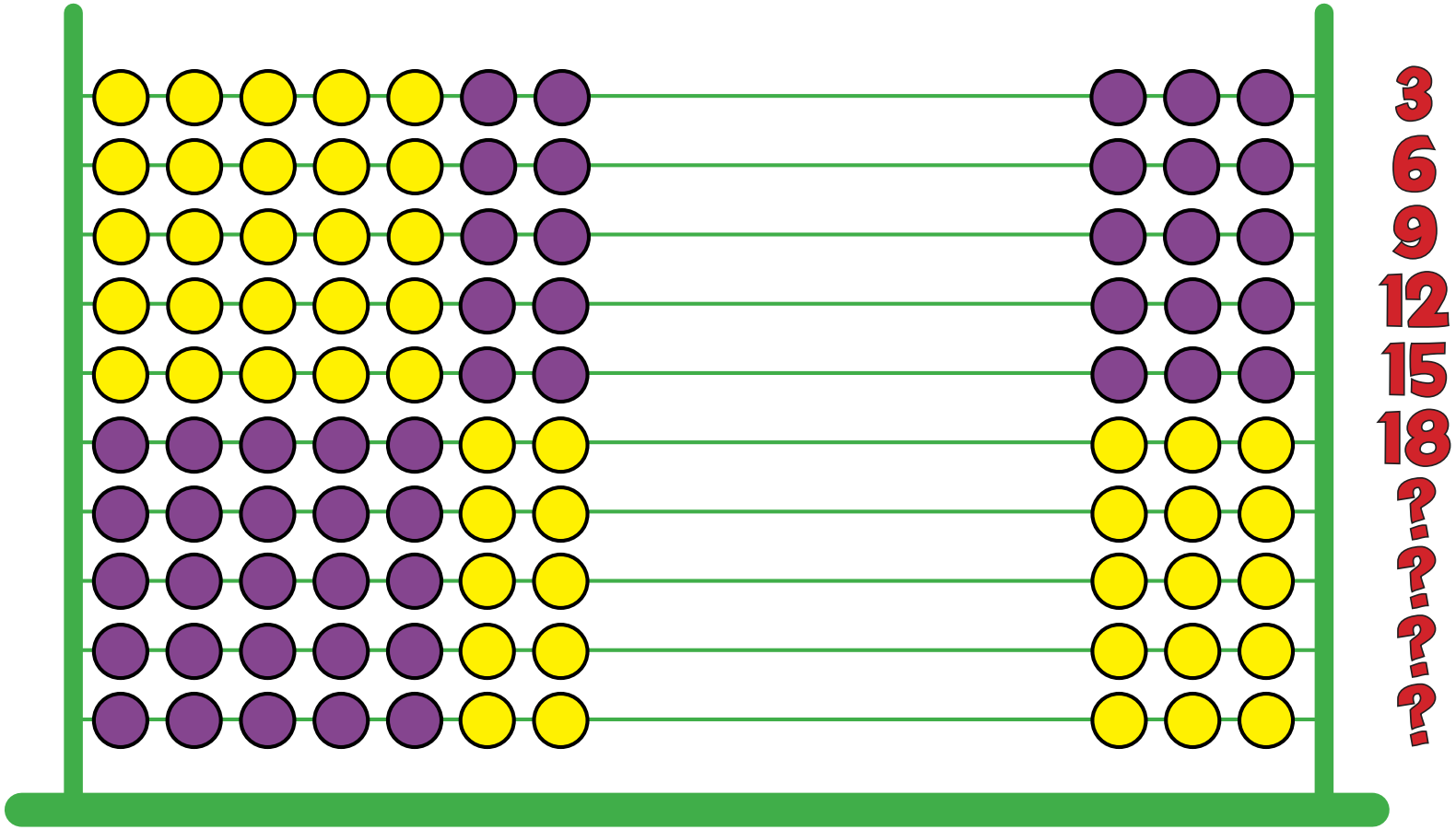


AD: Abacus

3/4a

$$y = 3x$$

x	x3	y
1	→	3
2	→	6
3	→	9
4	→	12
5	→	15
6	→	18

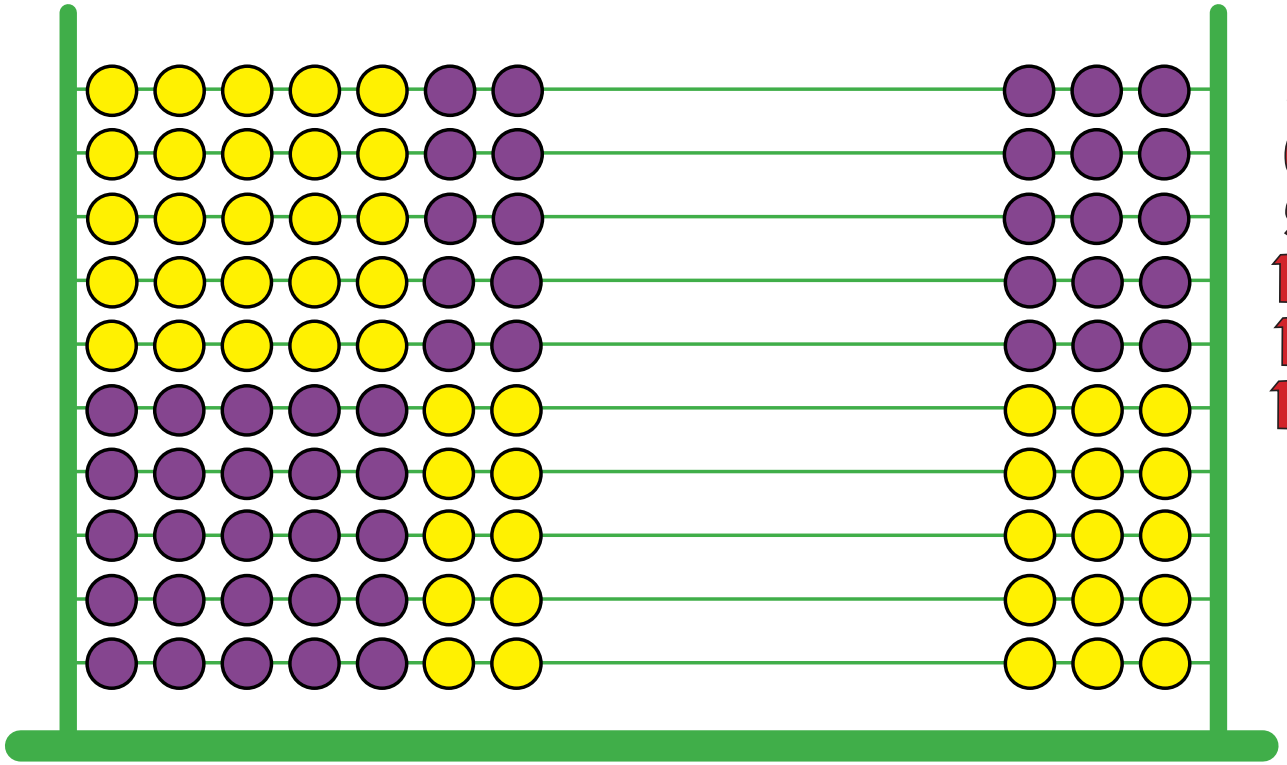


AD: Abacus

3/4b

$$y = 3x$$

x	x3	y
1	→	3
2	→	6
3	→	9
4	→	12
5	→	15
6	→	18



3 △

6 △△

9 △△△

12 △△△△

15 △△△△△

18 △△△△△△

? △△△△△△△

? △△△△△△△△

? △△△△△△△△△

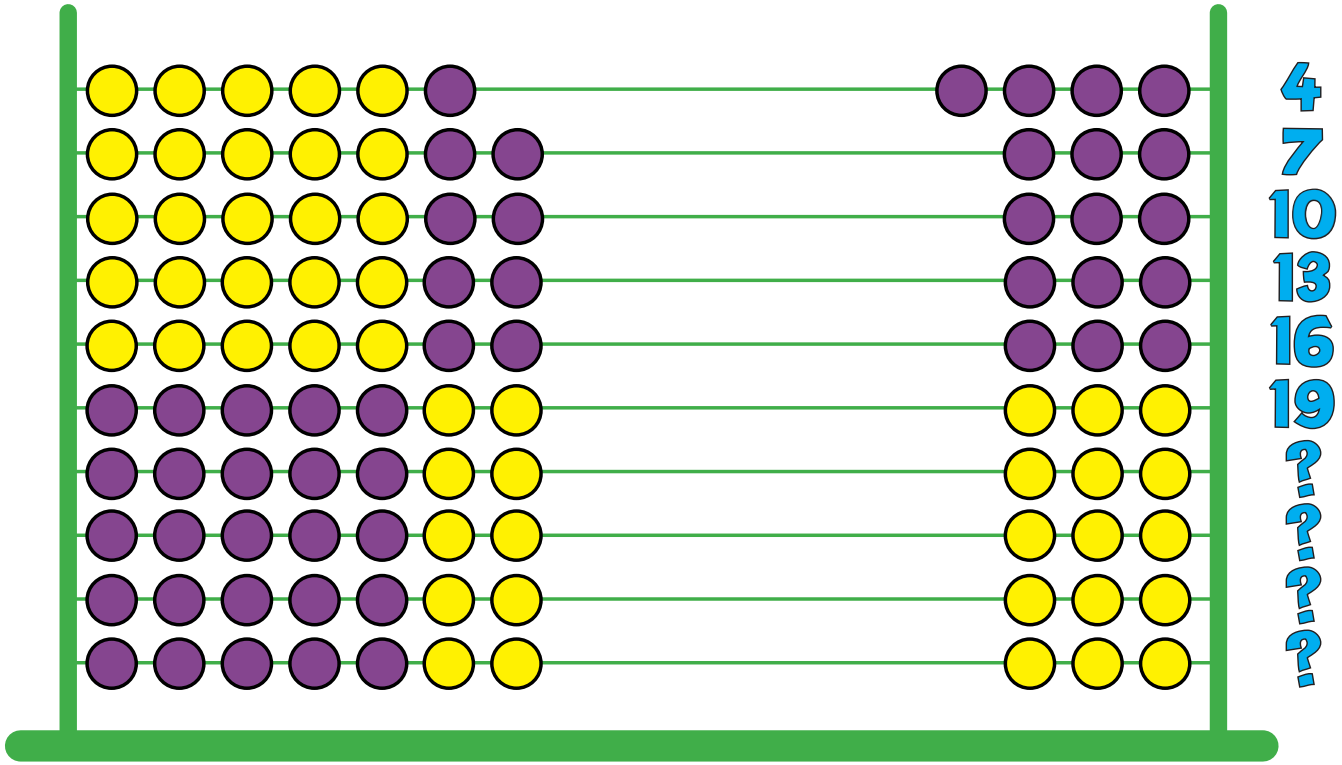
? △△△△△△△△△△

AD: Abacus

3/4c

$$y = 3x + 1$$

x	x3	y	+1	y
1	→	3	→	4
2	→	6	→	7
3	→	9	→	10
4	→	12	→	13
5	→	15	→	16
6	→	18	→	19

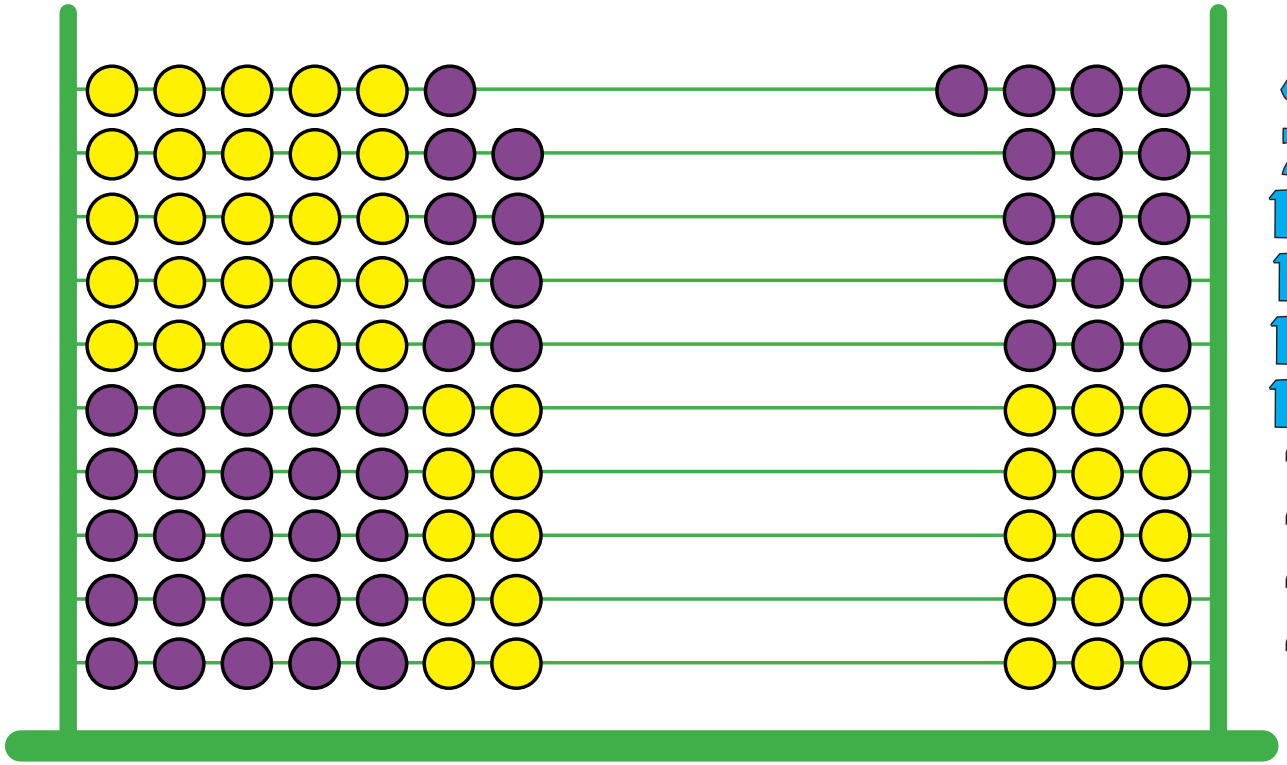


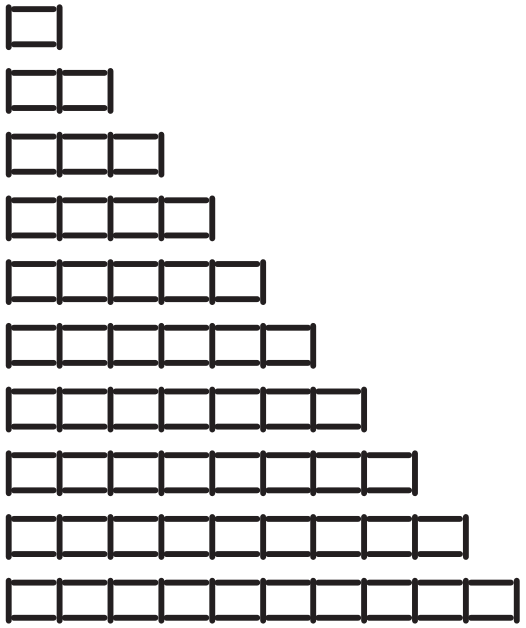
AD: Abacus

5/6

$$y = 3x + 1$$

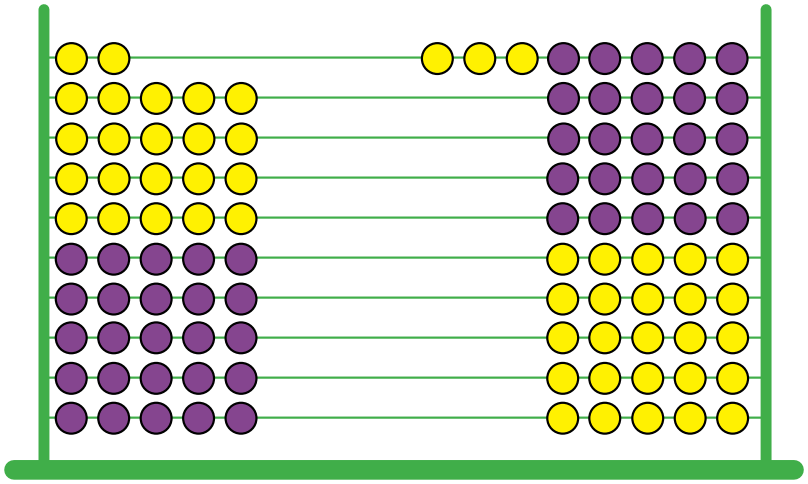
x	x3	y	+1	y
1	→	3	→	4
2	→	6	→	7
3	→	9	→	10
4	→	12	→	13
5	→	15	→	16
6	→	18	→	19



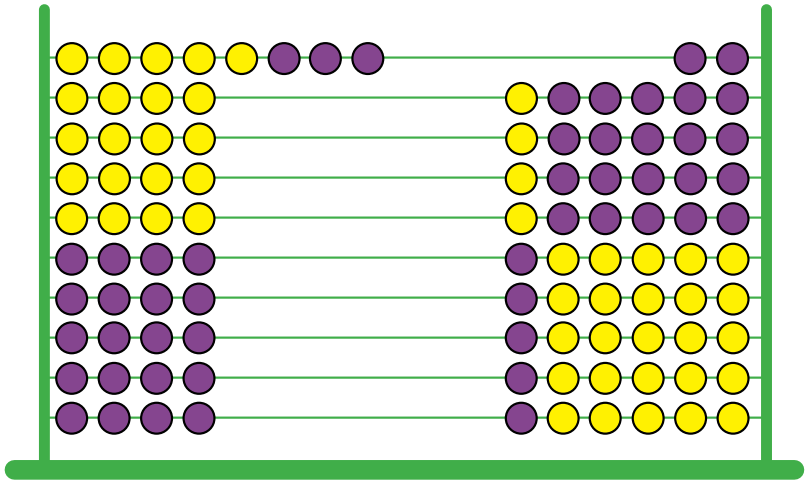


AD: Abacus

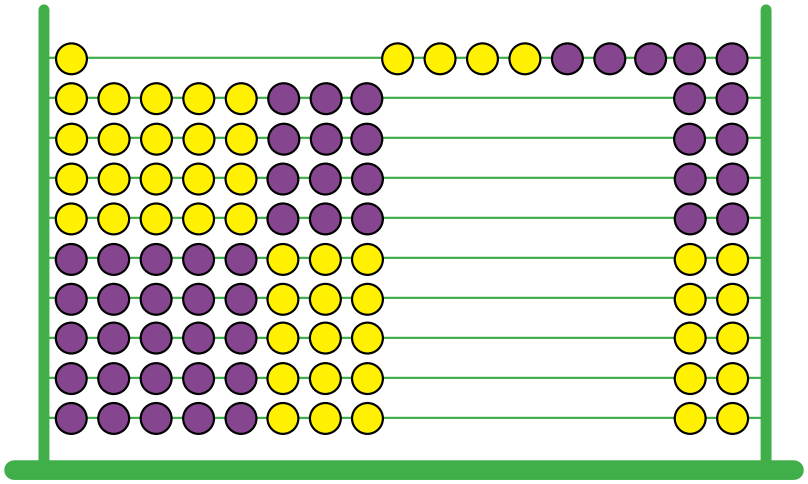
6



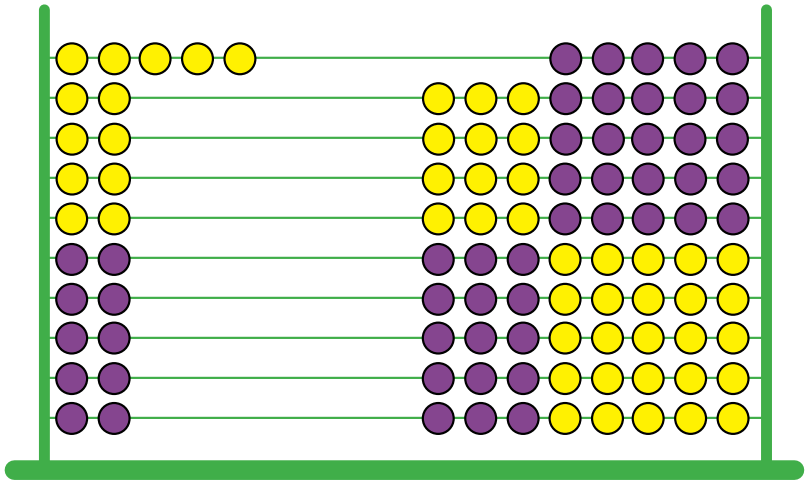
$y = 5x + 3$



$y = 6x - 4$



$y = 2x + 7$

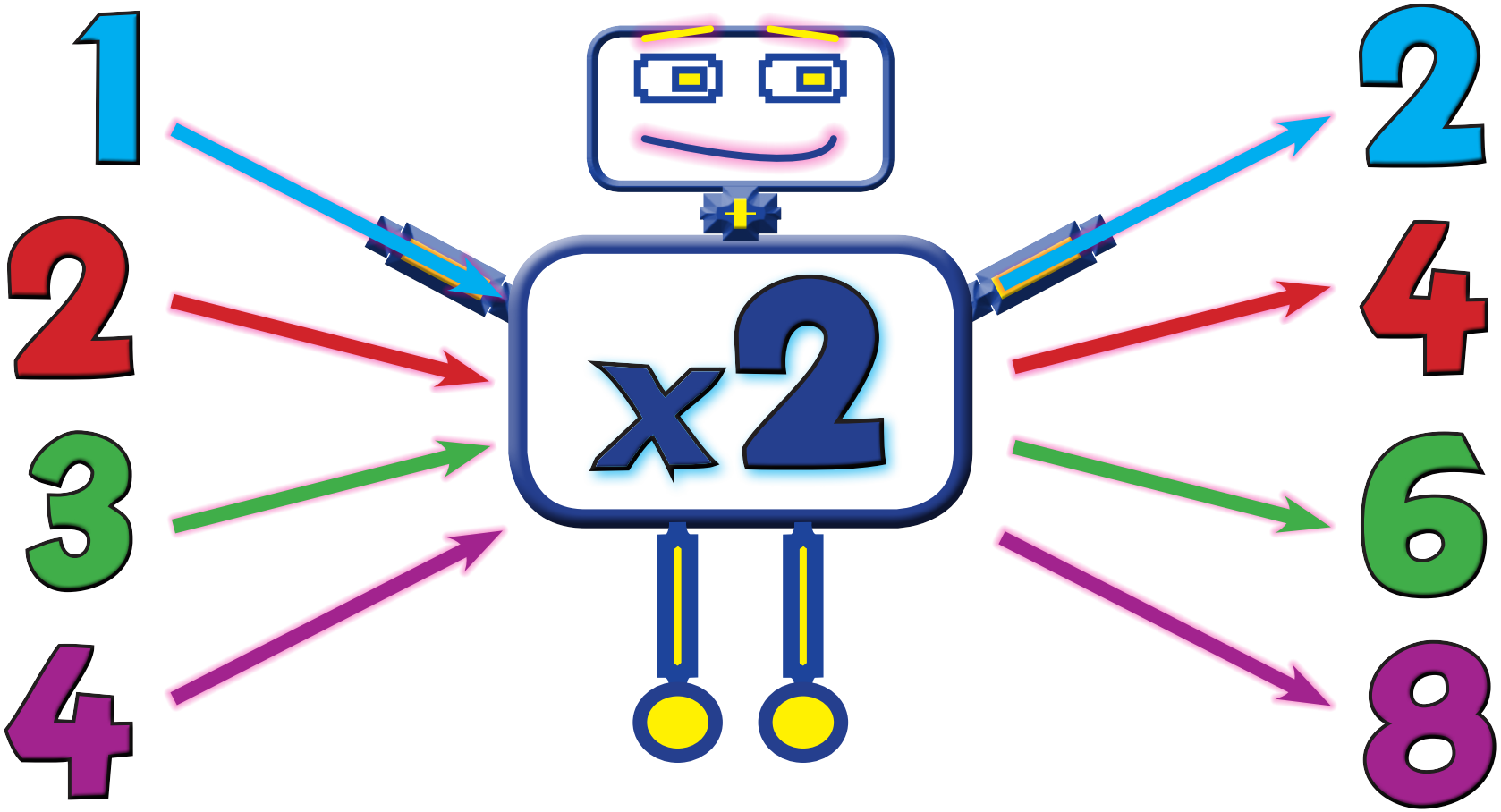


$y = 8x - 3$

AE: Doubling Machines

1

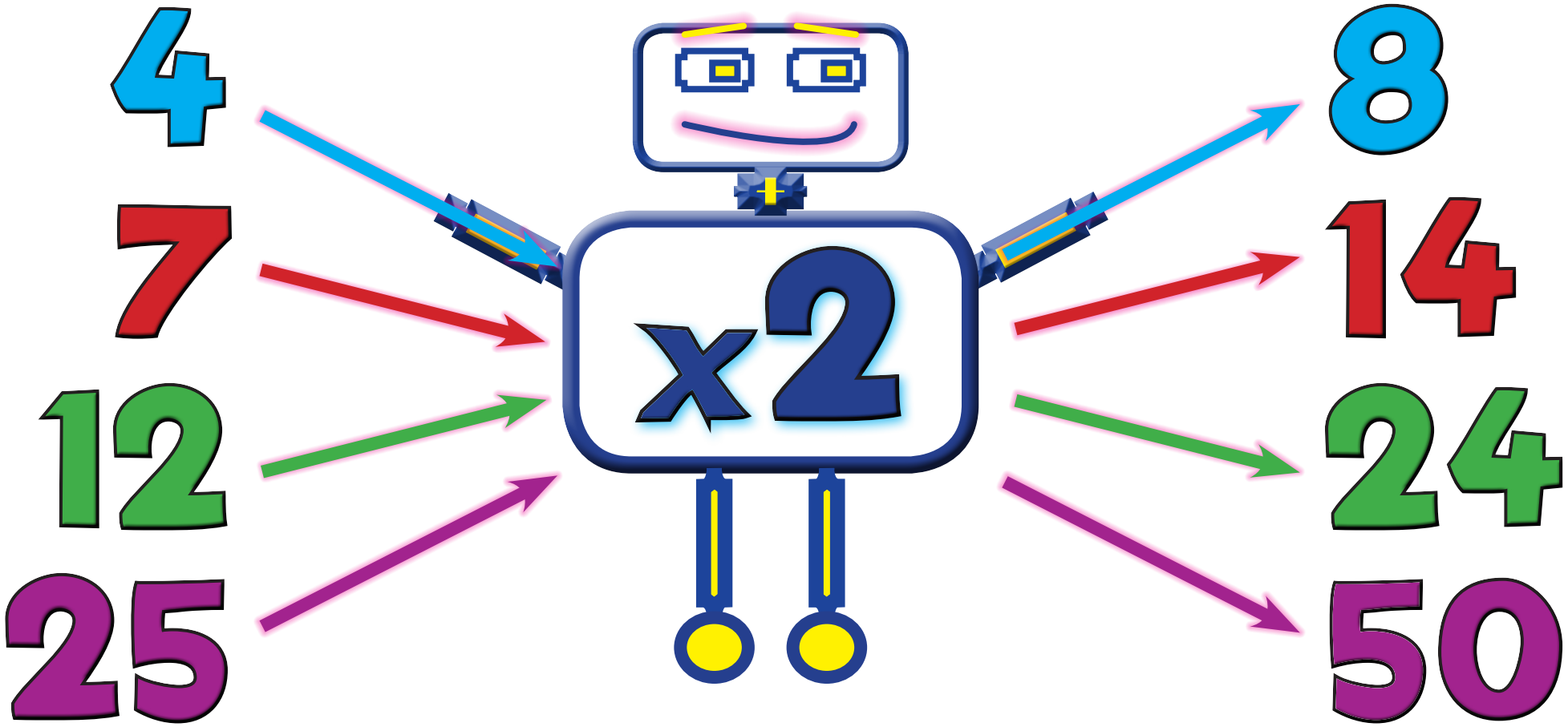
Numerical Order



AE: Doubling Machines

2a

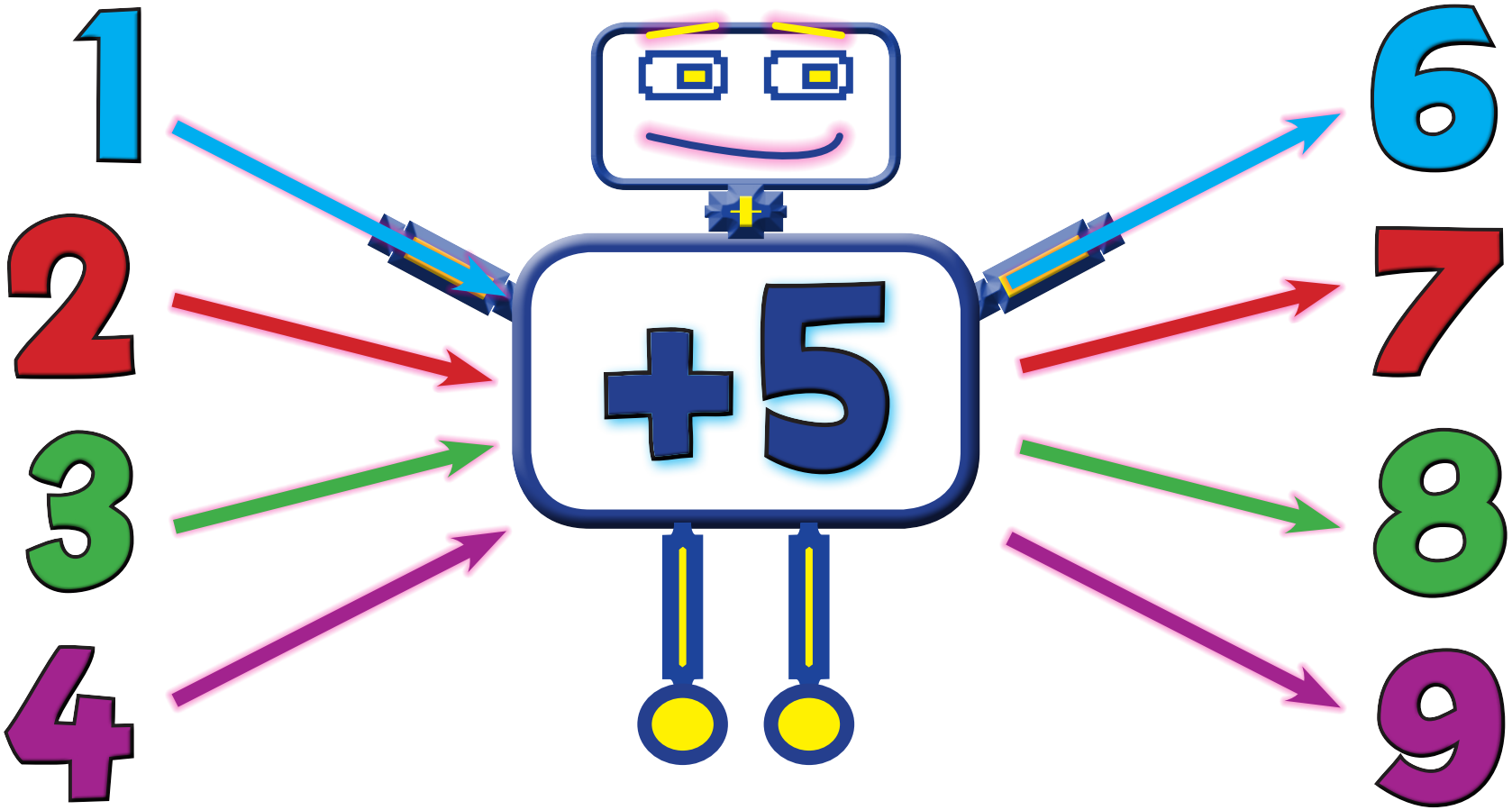
Random



AE: Function Machines

2b

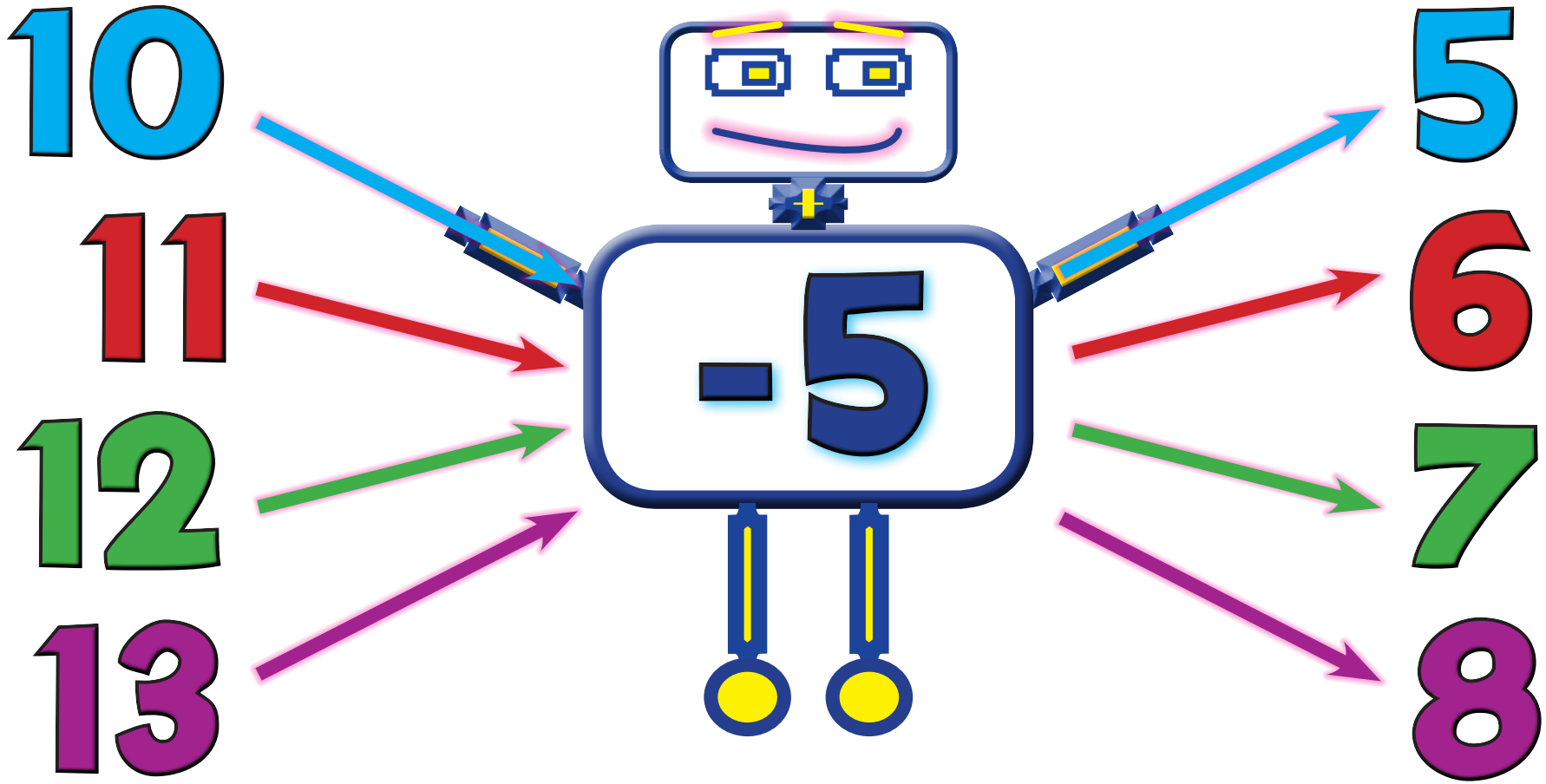
Numerical Order



AE: Function Machines

2c

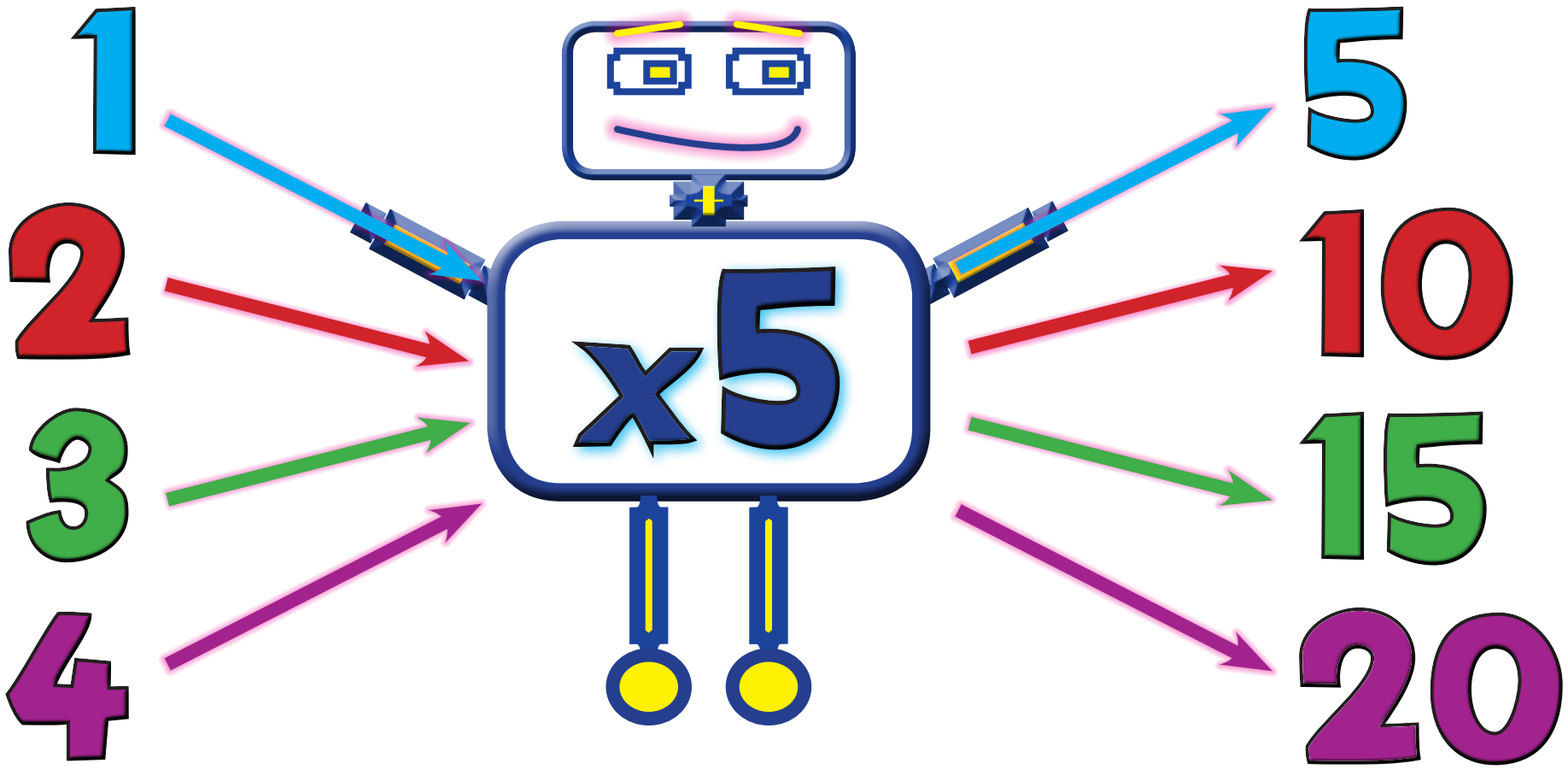
Numerical Order



AE: Function Machines

2d

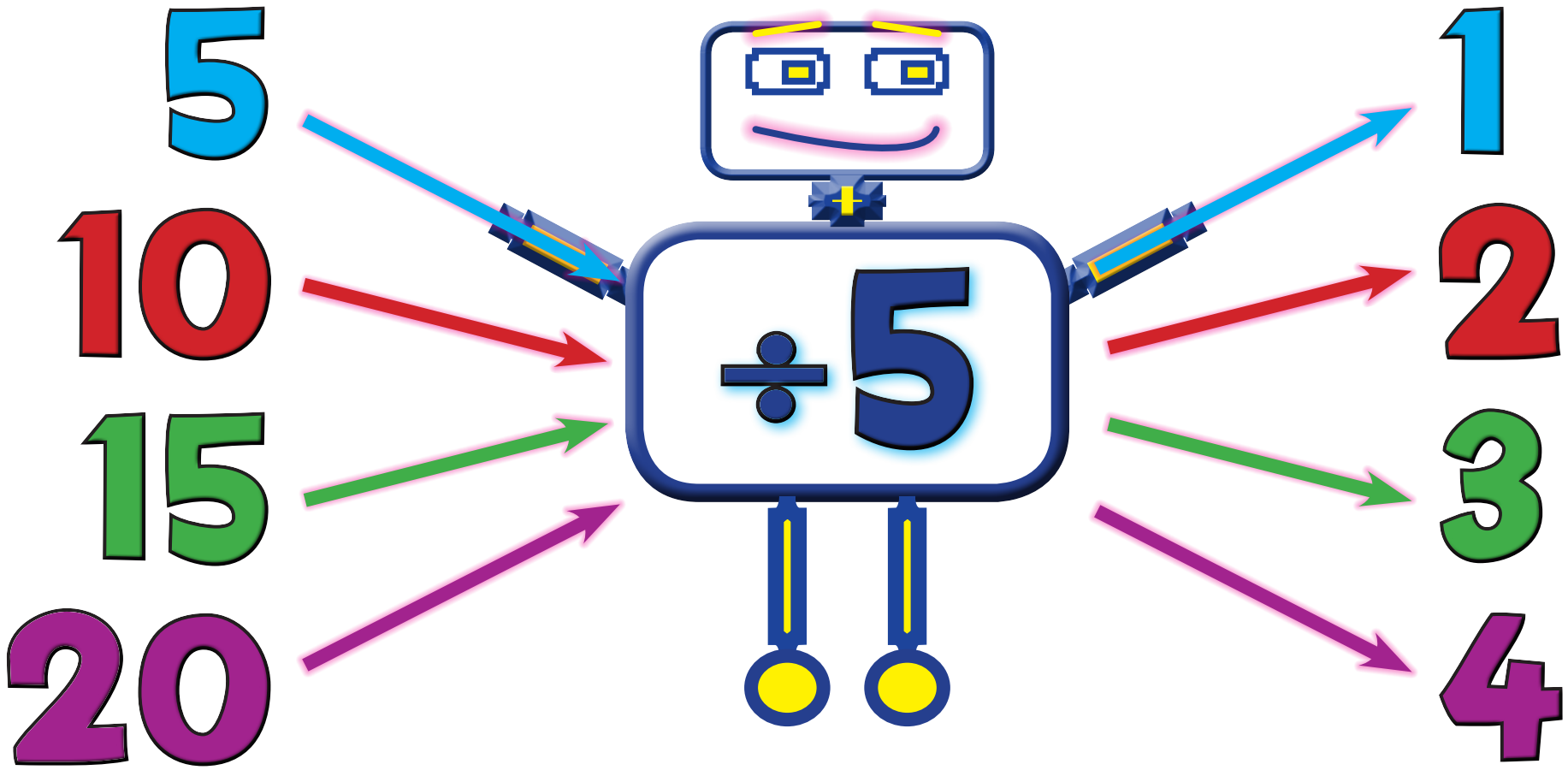
Numerical Order



AE: Function Machines

2e

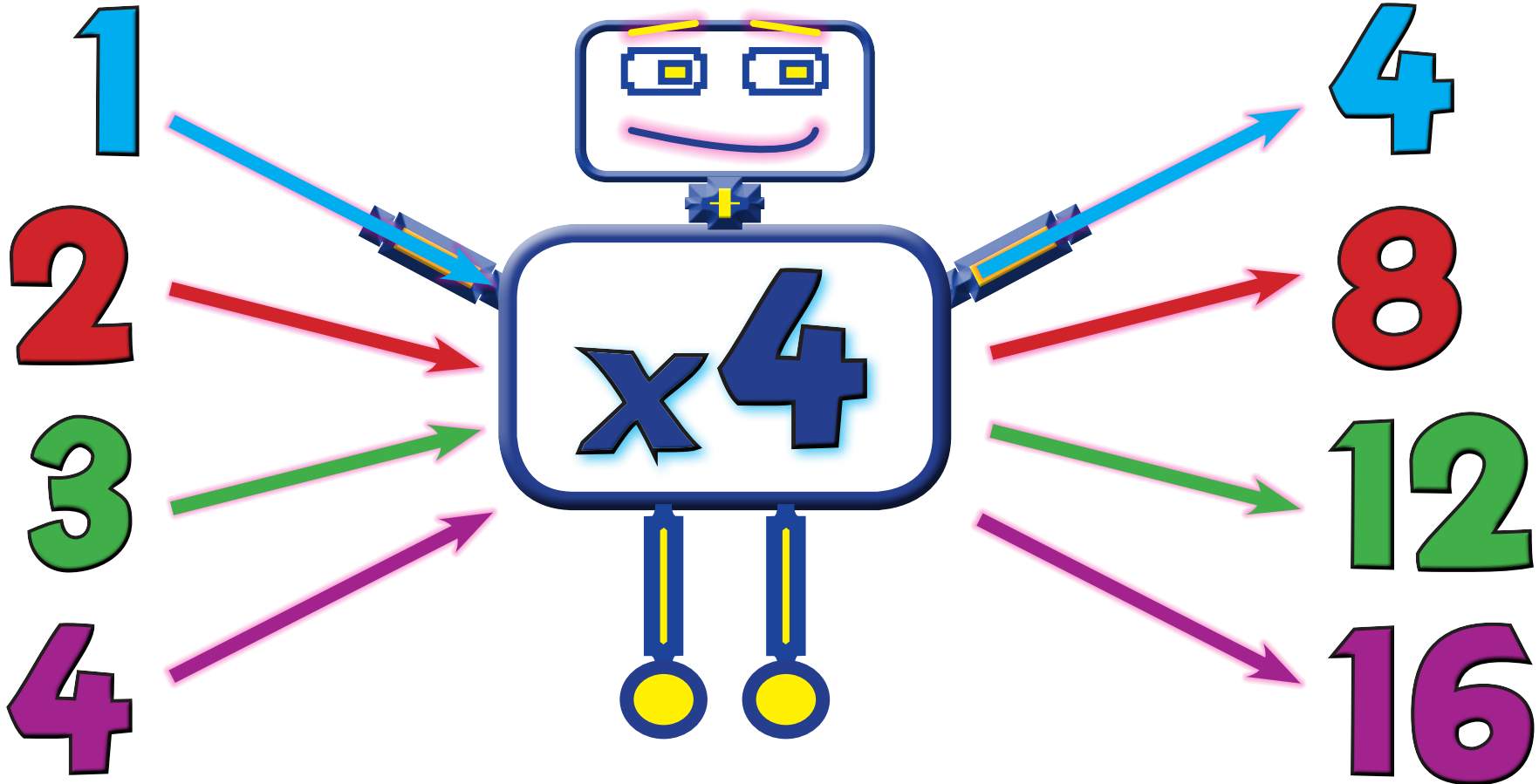
Numerical Order



AE: Function Machines

3a

Numerical Order

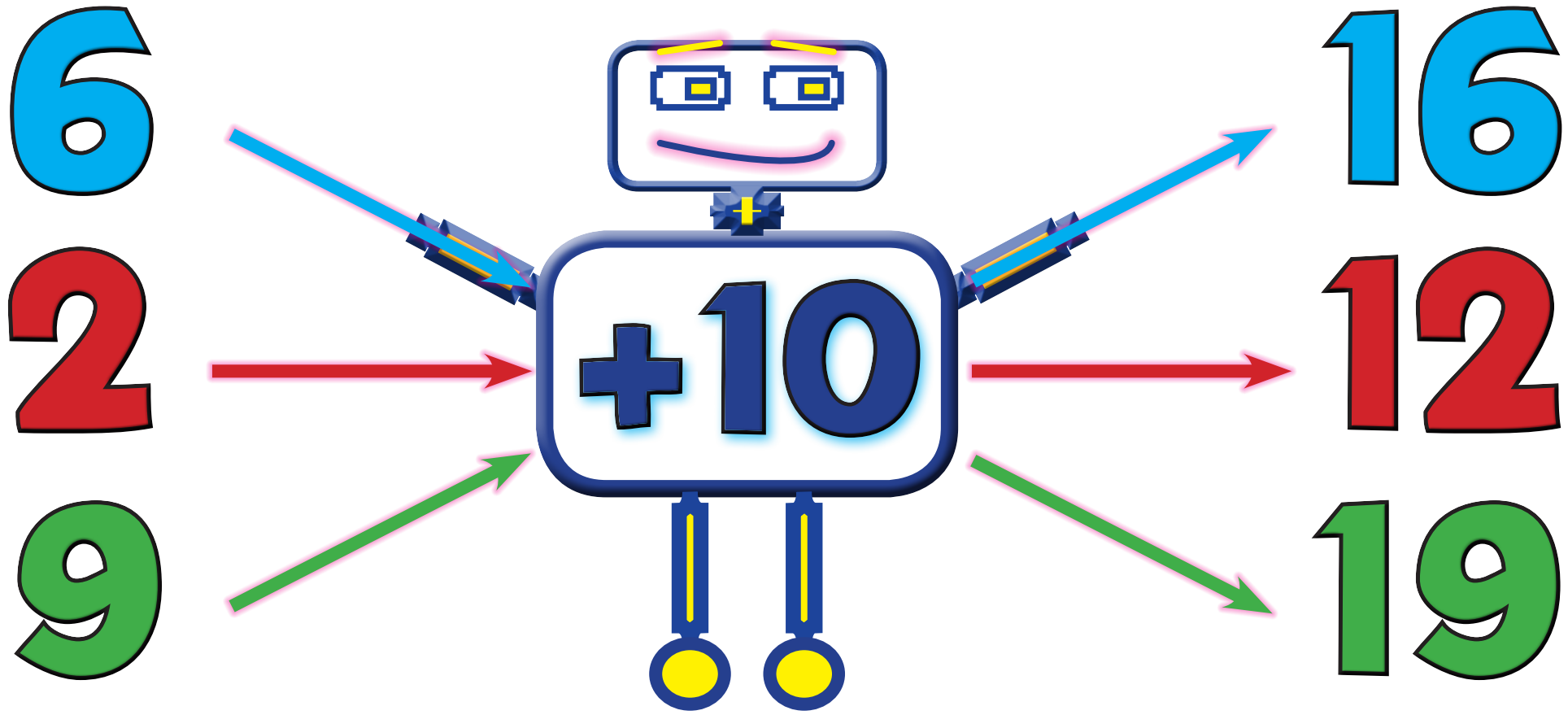


x	1	2	3	4	5	6	7	8	9	10
y	4	8	12	16	20	24	28	32	36	40

AE: Function Machines

3b

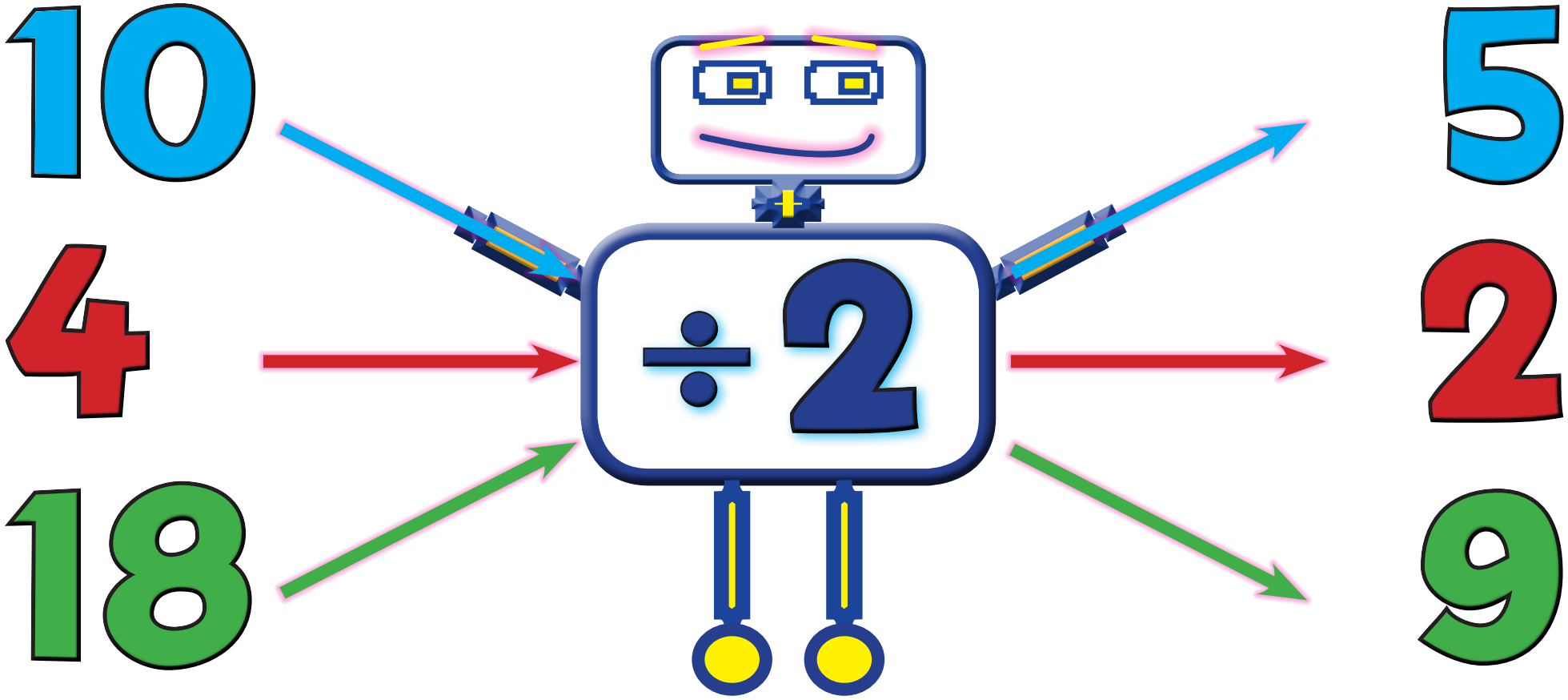
Random



AE: Function Machines

3c

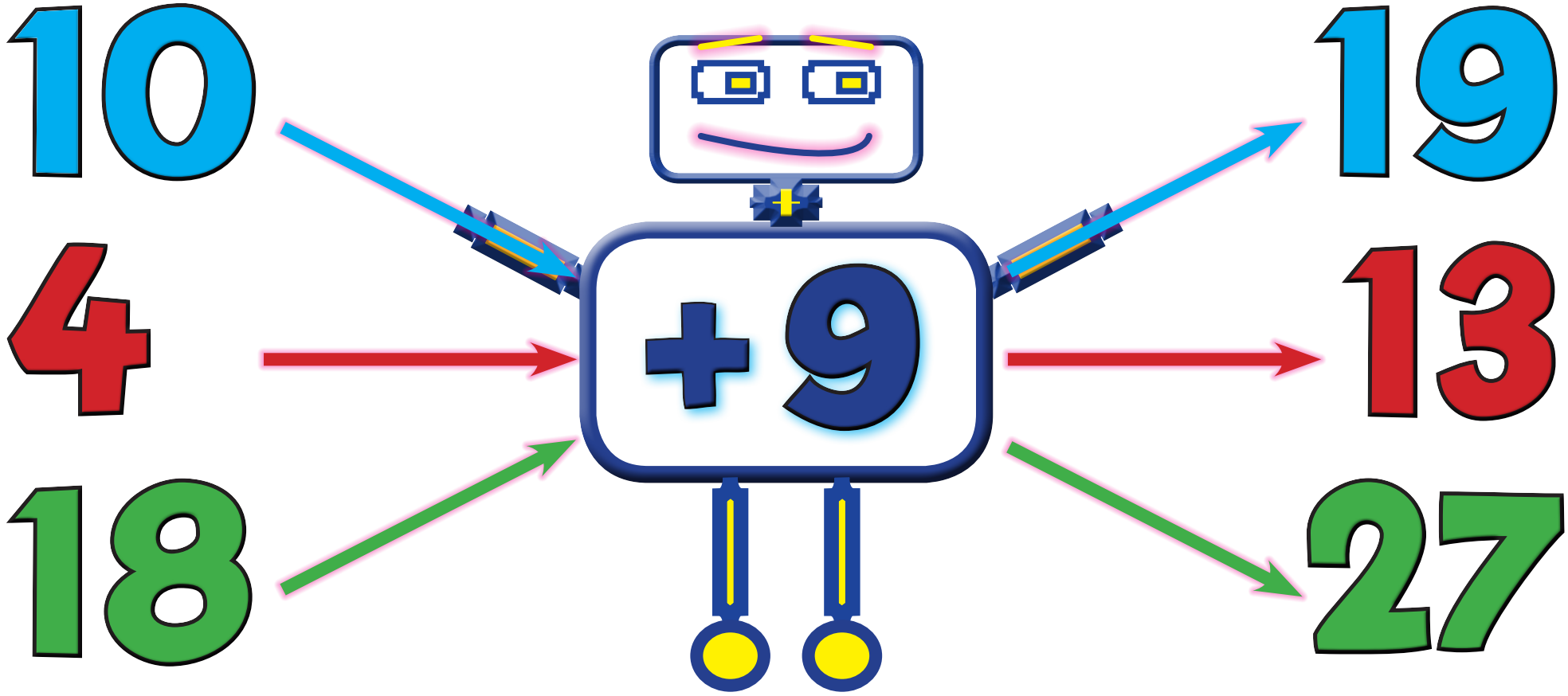
Random



AE: Function Machines

3d

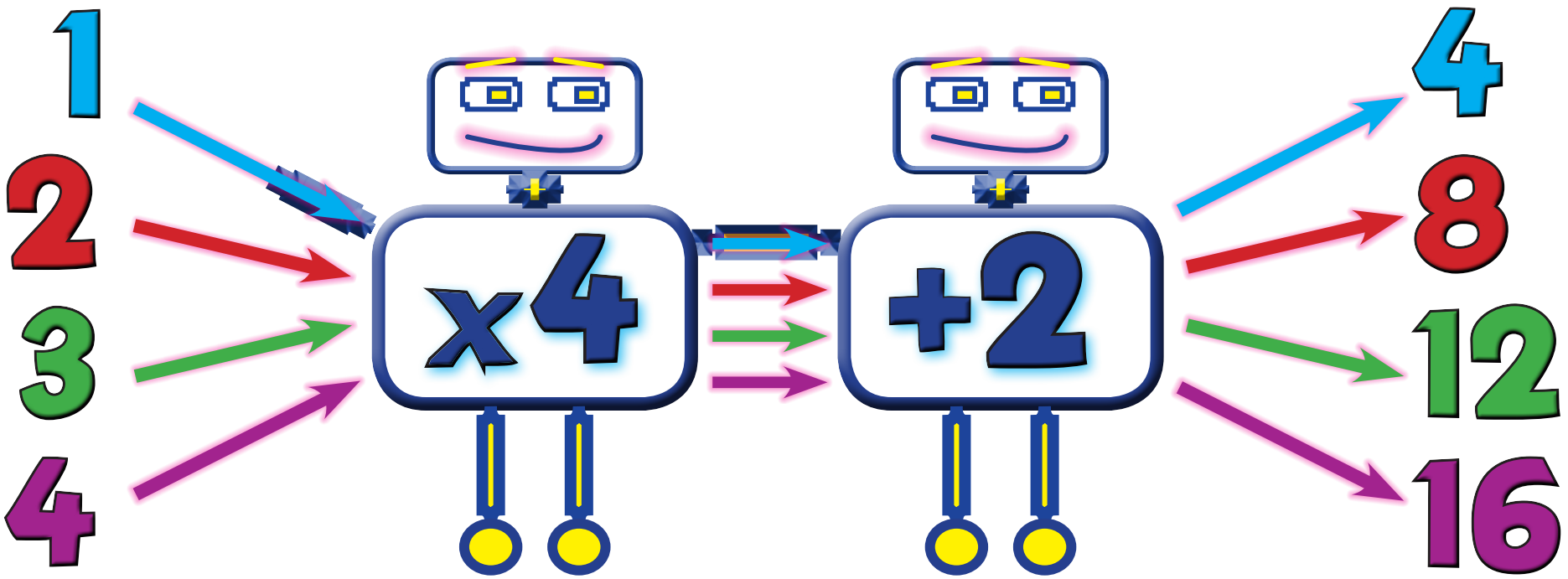
Random



AE: Function Machines

4a

Numerical Order

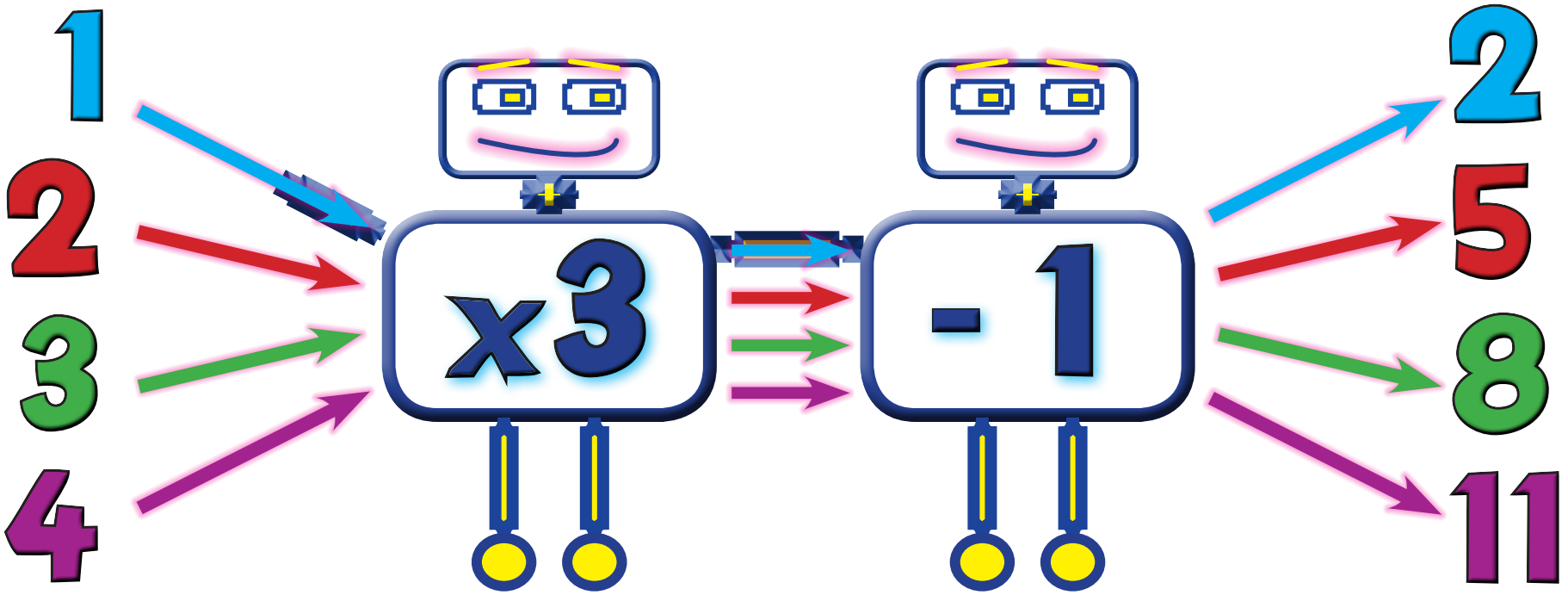


x	1	2	3	4	5	6	7	8	9	10
x4	4	8	12	16	20	24	28	32	36	40
+2	6	10	14	18	22	26	30	34	38	42

AE: Function Machines

4b

Numerical Order

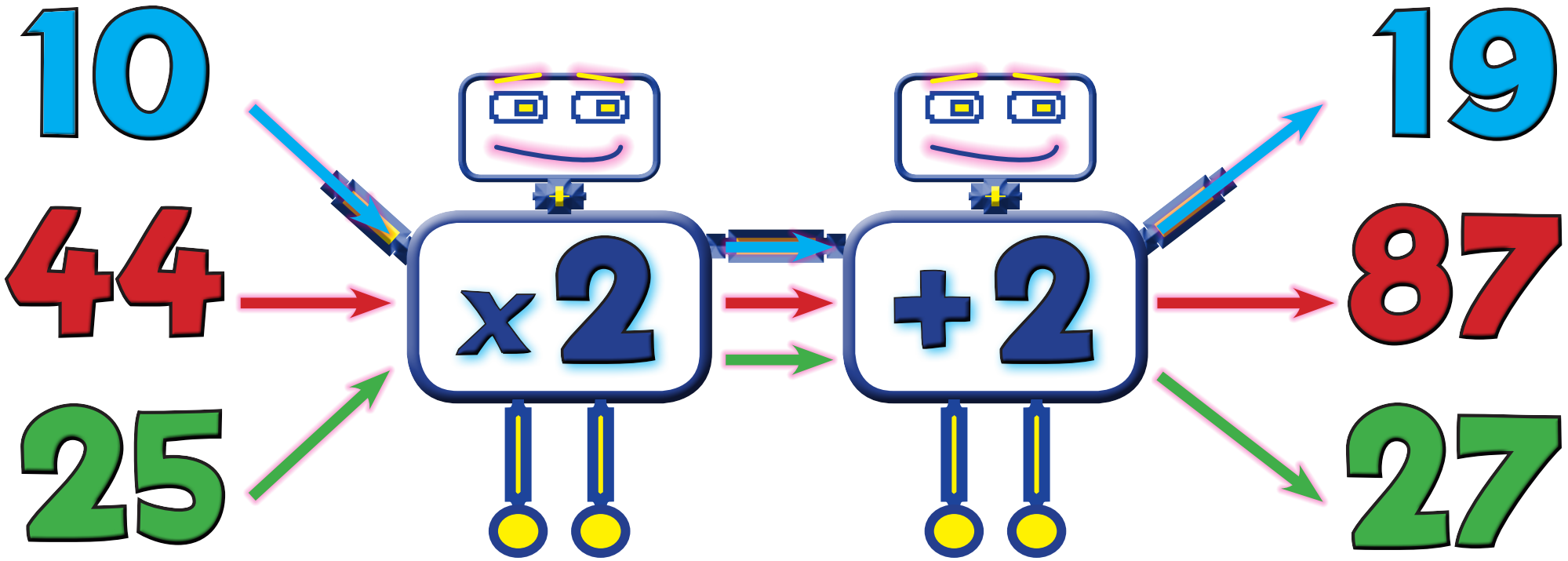


x	1	2	3	4	5	6	7	8	9	10
x3	3	6	9	12	15	18	21	24	27	30
-1	2	5	8	11	14	17	20	23	26	29

AE: Function Machines

4c

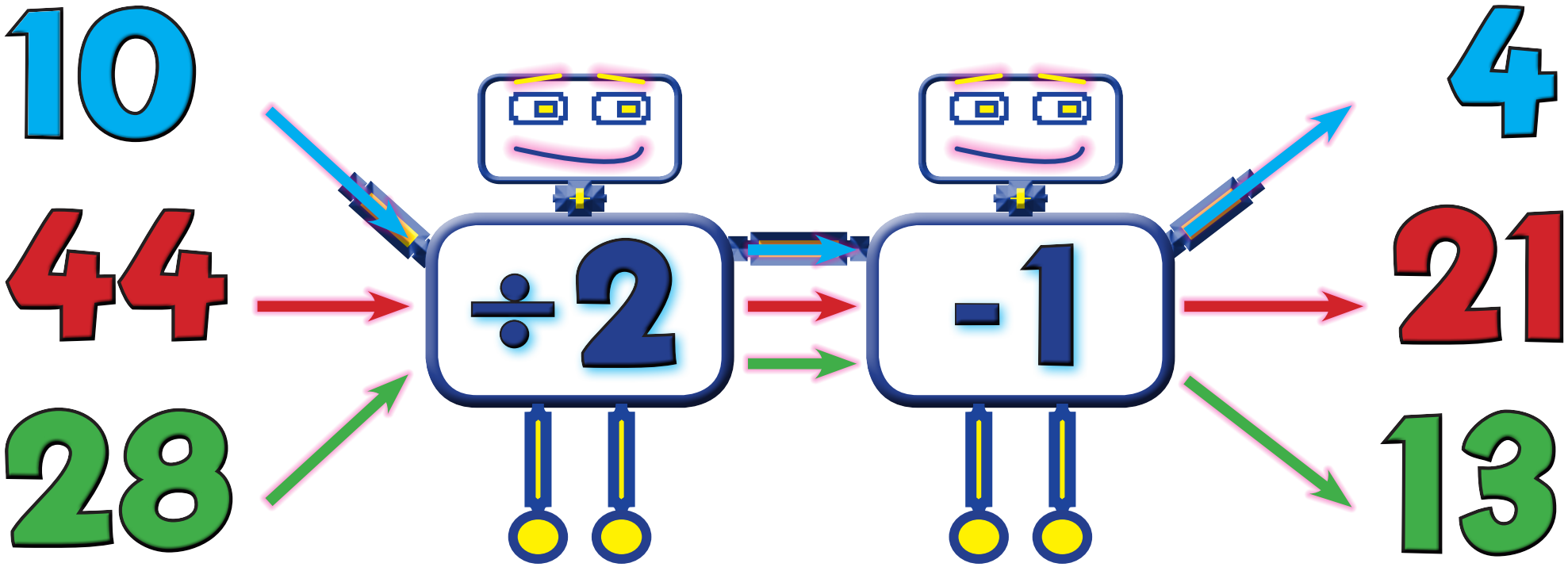
Random



AE: Function Machines

4d

Random



AE: Function Machines

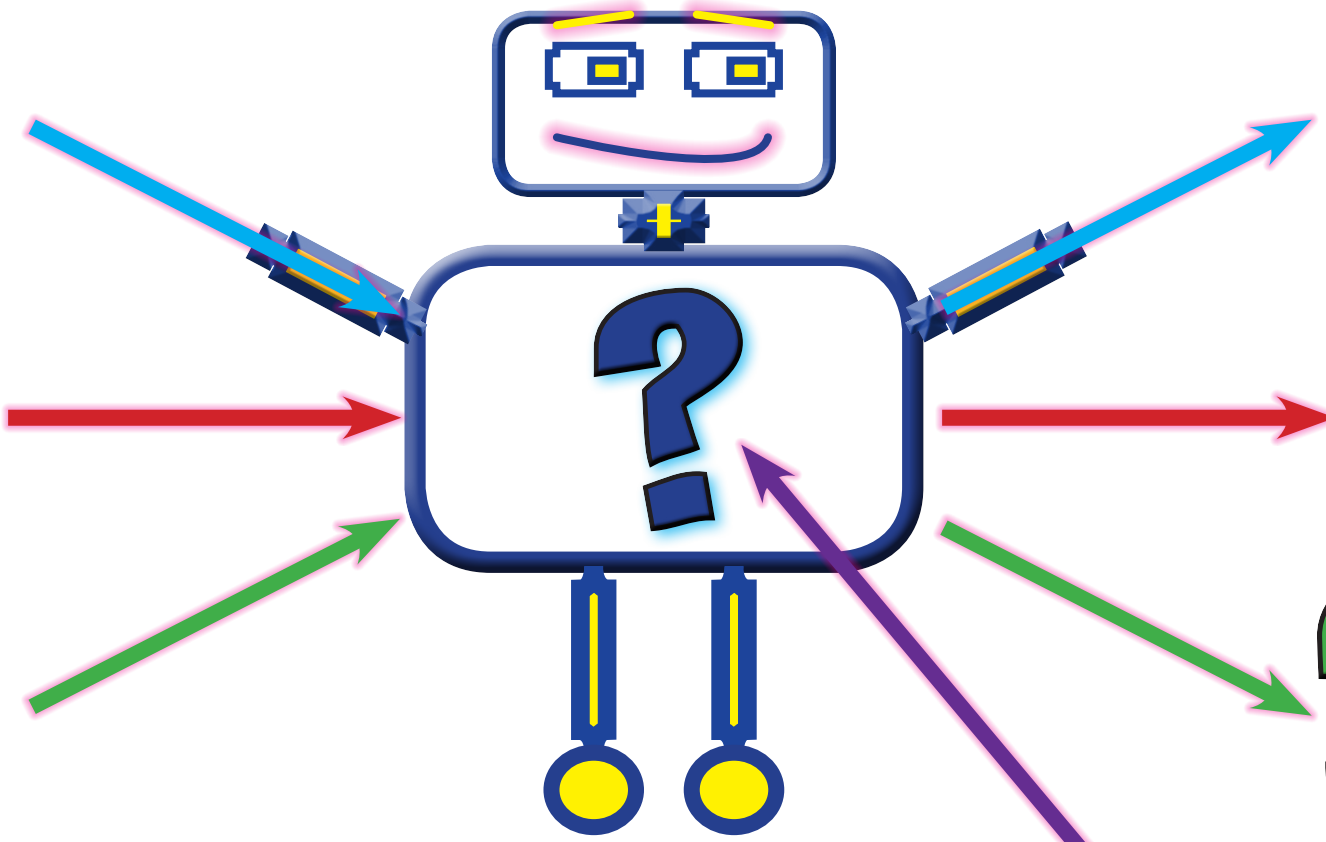
5

Random

2

3

5



12

17

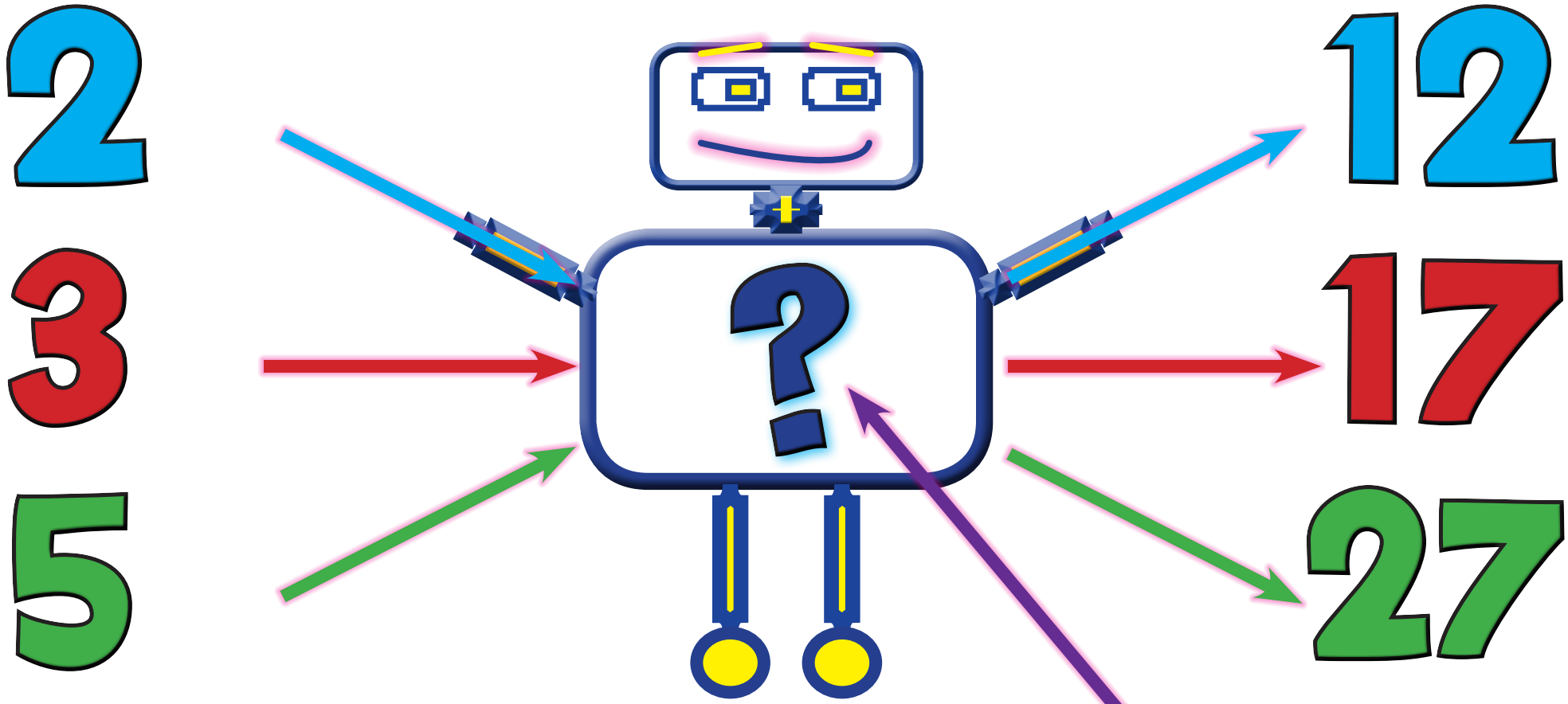
27

8 Maps onto ?

x5 then +2

AE: Function Machines

6a



n Maps onto ?

x5 then +2

AE: Function Machines

6b

Guardian of the Rule

1 Maps onto 7

2 Maps onto 12

3 Maps onto 17

4 Maps onto 22

10 Maps onto 52

n Maps onto ?

Here's the Guardian's nth term Rule!

"5n + 2!"

AE: Function Machines

6c

Guardian of the Rule

1 Maps onto 4

2 Maps onto 8

3 Maps onto 12

4 Maps onto 16

10 Maps onto 20

n Maps onto ?

Here's the Guardian's nth term Rule!

"4n!"

AE: Function Machines

6d

Guardian of the Rule

1 Maps onto 2

2 Maps onto 6

3 Maps onto 10

4 Maps onto 14

10 Maps onto 38

n Maps onto ?

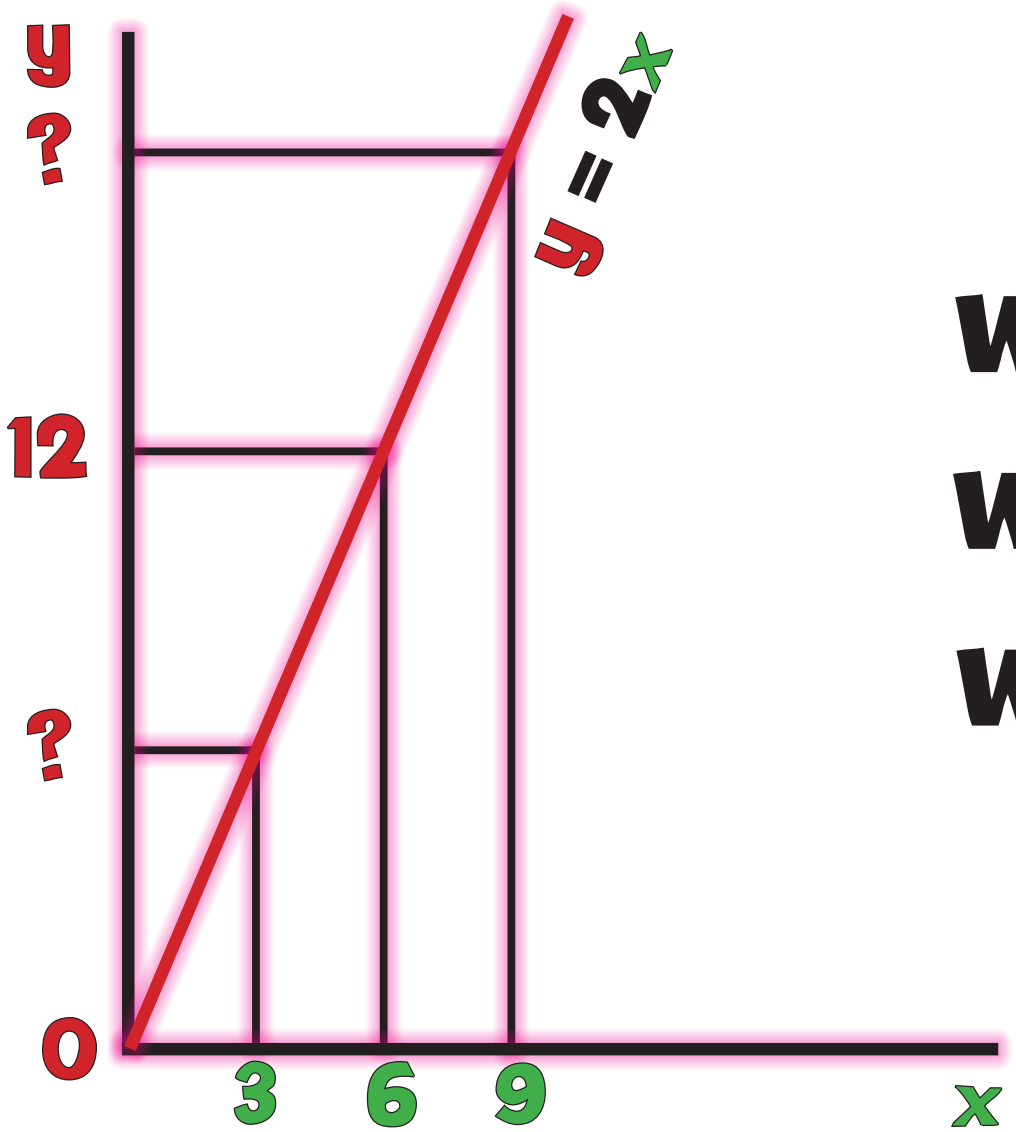
Here's the Guardian's nth term Rule!

"4n - 2!"

AF: Times Tables

Sequence on a Graph

4a



When x is 3, y is ?

When x is 6, y is 12

When x is 9, y is ?

AF: Terms of a Sequence

4b

First Term						10th Term	100th Term
1	2	3	4	5	→	10	100
					→		

First Term is _____

Step Size is _____

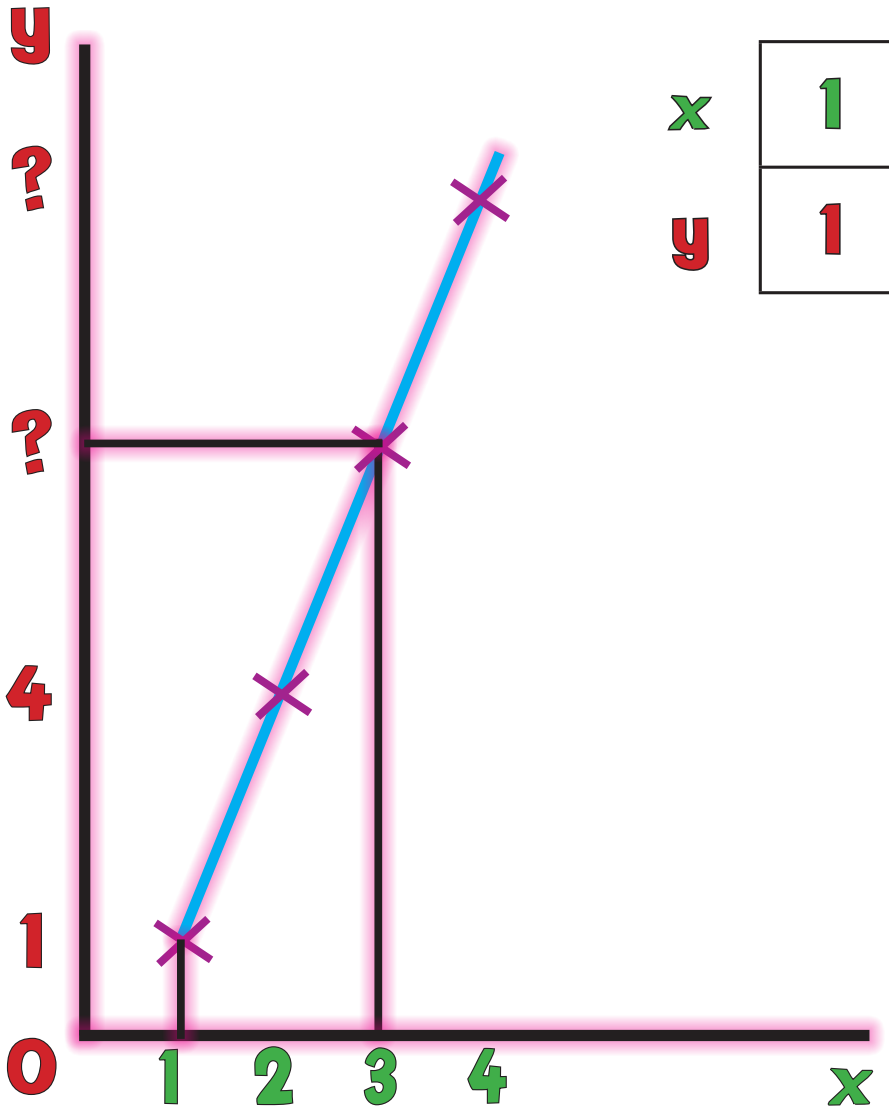
10th Term will be _____

100th Term will be _____

Hint: Compare the sequence to the step size times-table

AF: Graphing a Sequence

5a

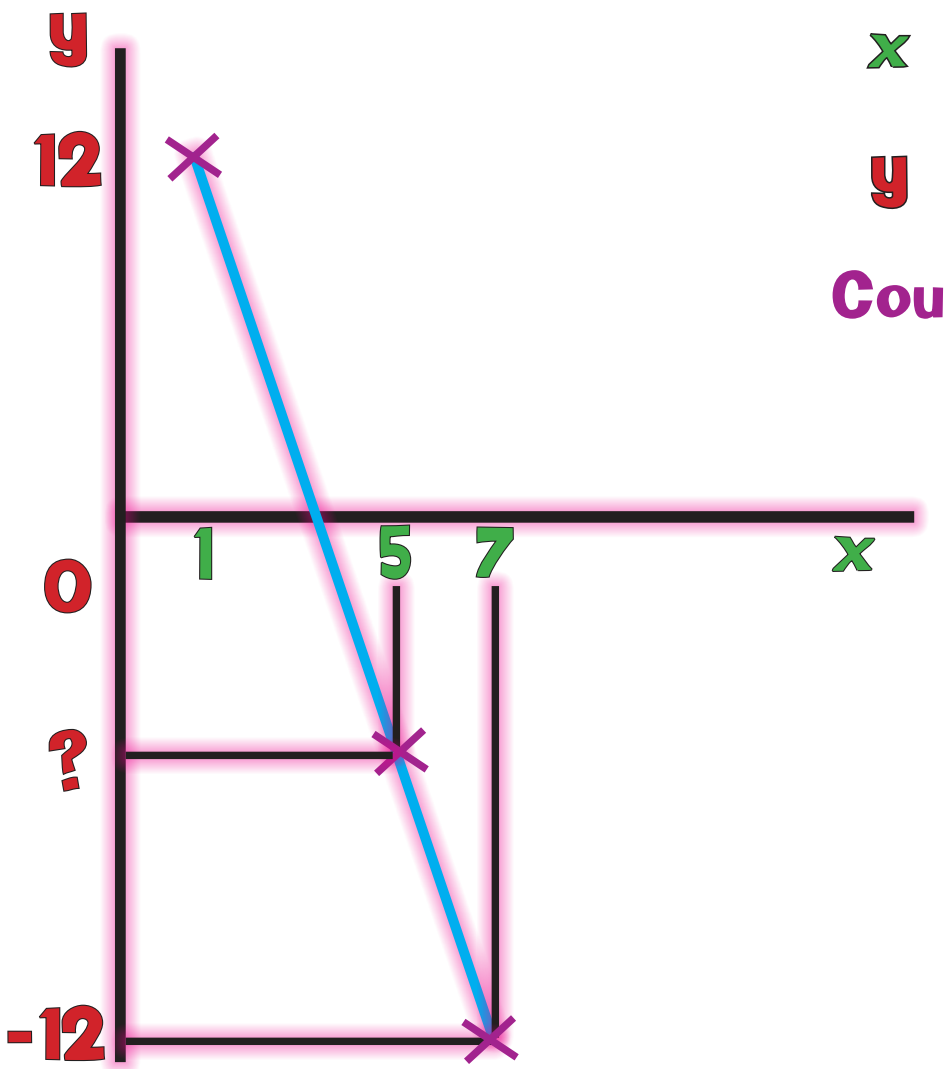


x	1	2	3	4	5	6	7	8
y	1	4	?	?	13	16	?	?

Counting on in 3's, starting at 1

AF: Graphing a Sequence

5b

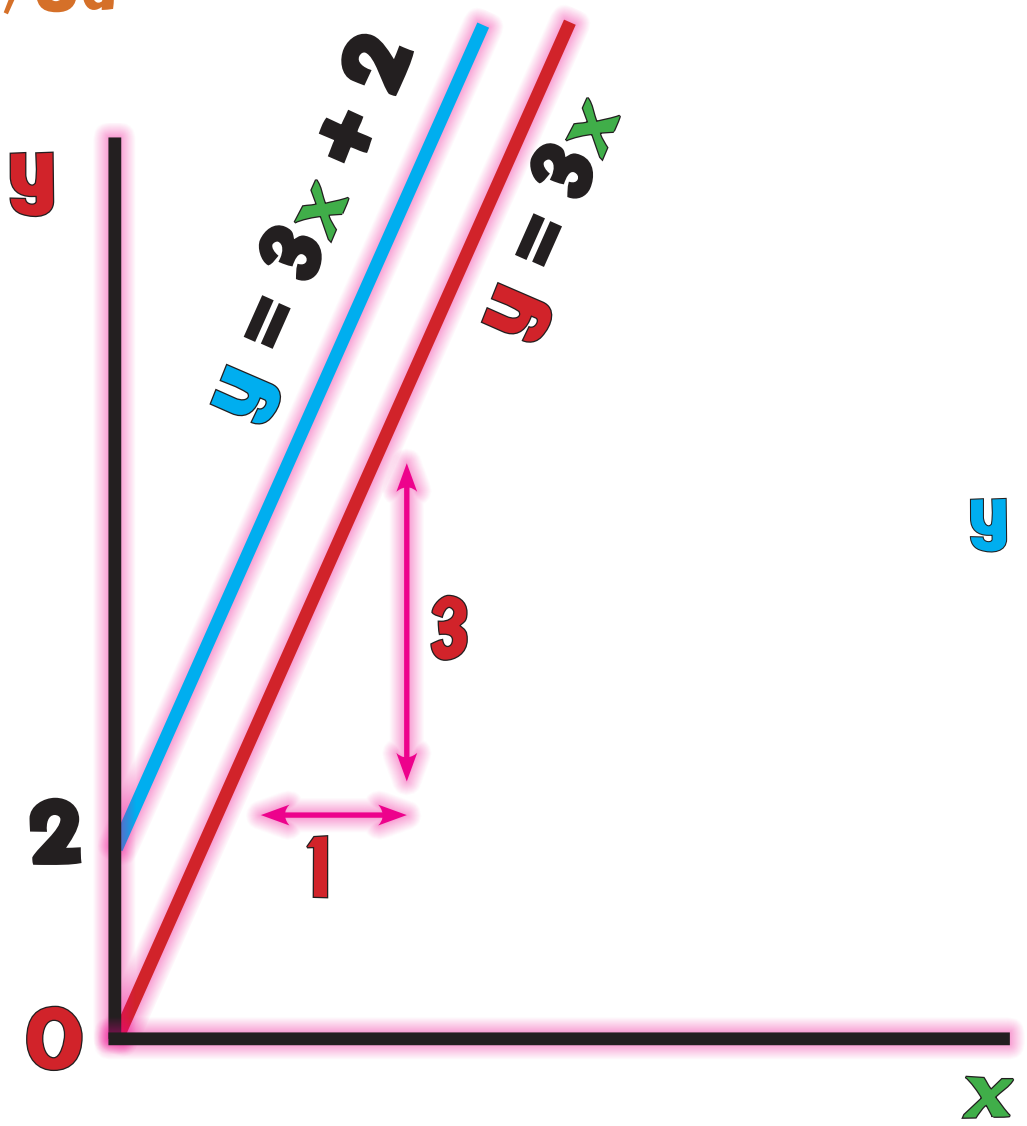


x	1	2	3	4	5	6	7
y	12	8	4	0	?	?	-12

Counting back in 4's, starting at 12

AF: Shifting '3 Sequence'

5/6a



x	1	2	3	4	→	n
y = 3x	3	6	9	12	→	n
y = 3x + 2	5	8	11	14	→	n

Each term moves on 2!

AF: Terms of a Sequence

5/6c

First Term							nth Term
1	2	3	4	5	→	10	n
					→		

First Term is _____

Step Size is _____

10th Term will be _____

nth Term will be _____

Hint: Compare the sequence to the step size times-table

AF: Negative Sequence

5/6d

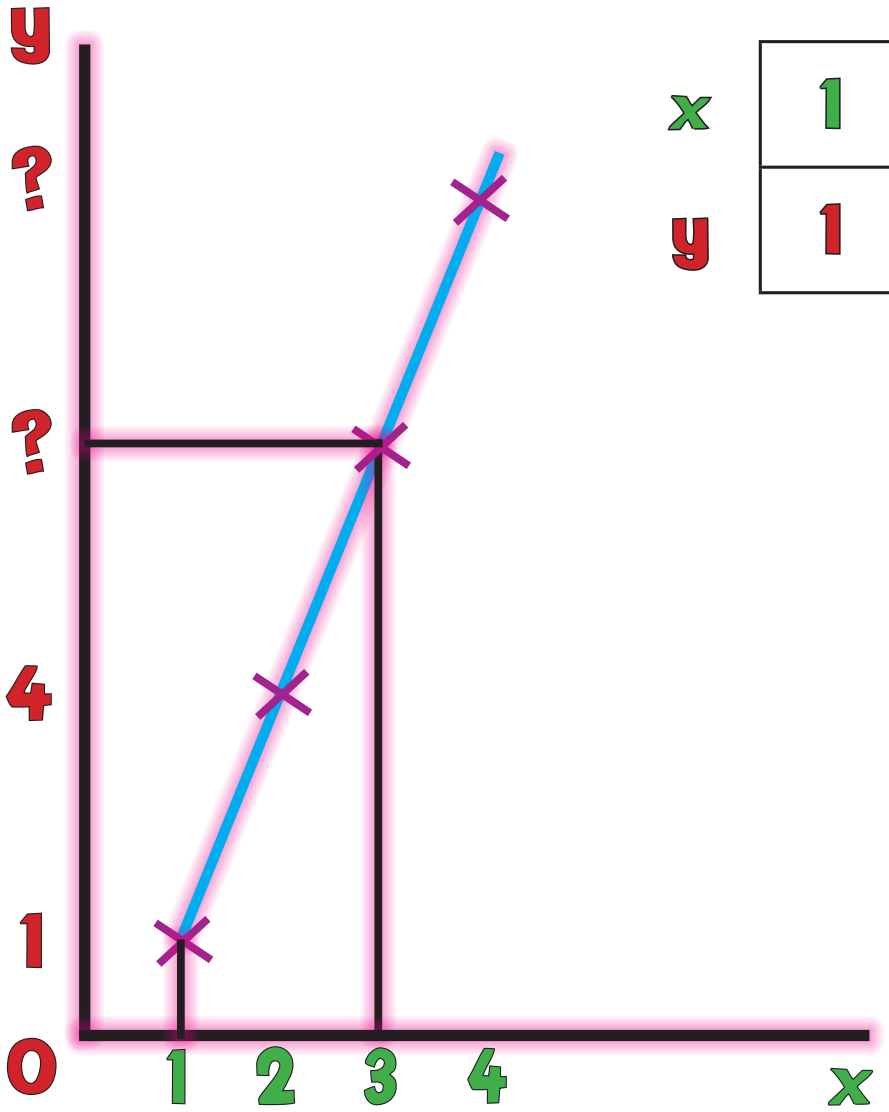
x	0	1	2	3	4	5	→	10	n
y	12	10	8	6	4	2	→		

Counting back in 2's, starting at 10

$$y = -2x + 12$$

AF: Graphing a Sequence

6a



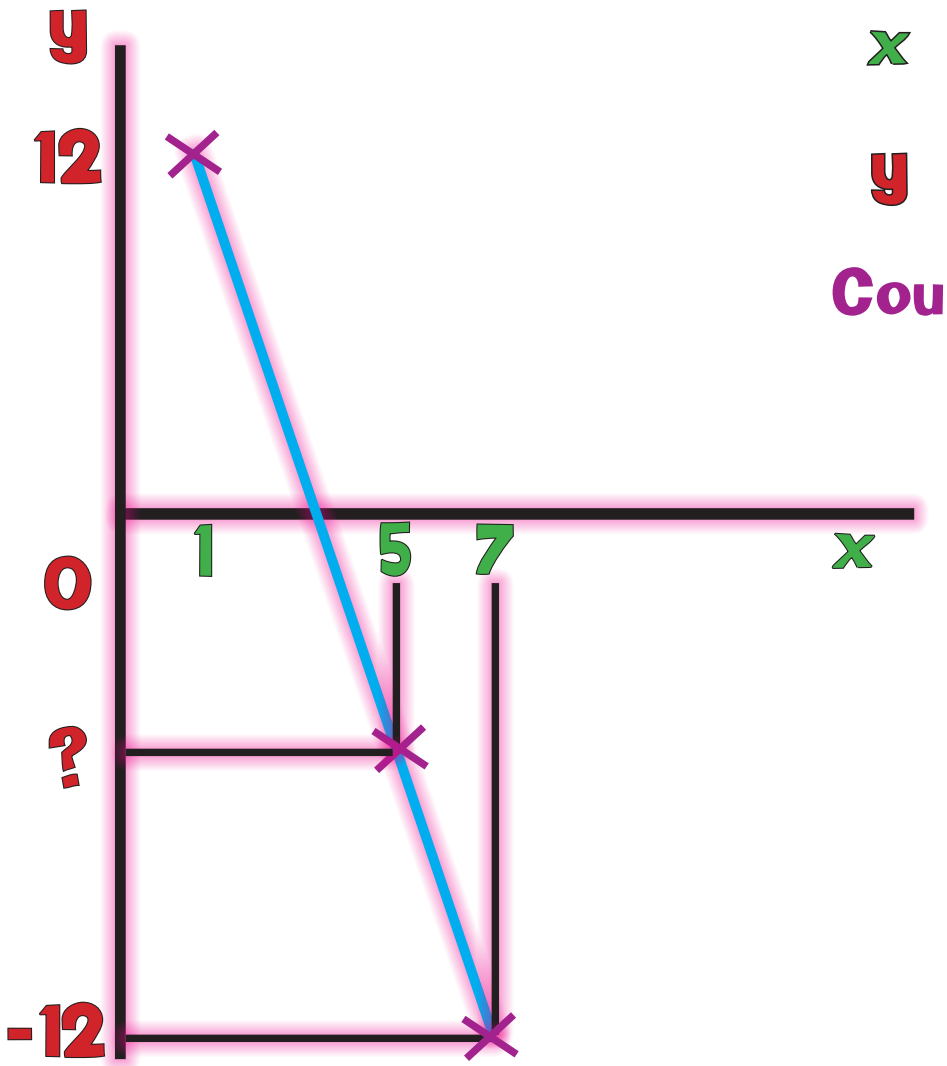
x	1	2	3	4	5	6	7	8
y	1	4	?	?	13	16	?	?

Counting on in 3's, starting at 1

$$y = 3x - 2$$

AF: Graphing a Sequence

6b



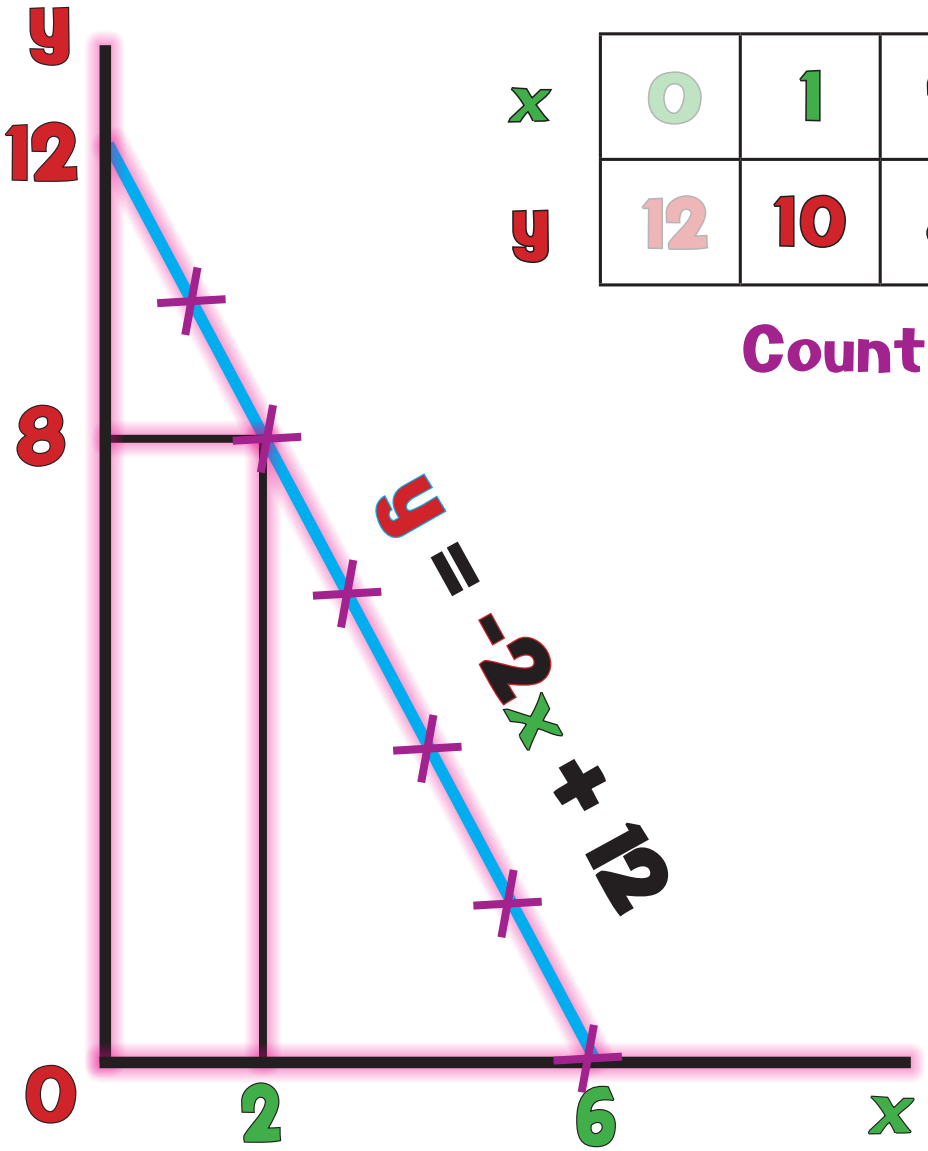
x	1	2	3	4	5	6	7
y	12	8	4	0	?	?	-12

Counting back in 4's, starting at 12

$$y = -4x + 16$$

AF: Negative Sequence

6c



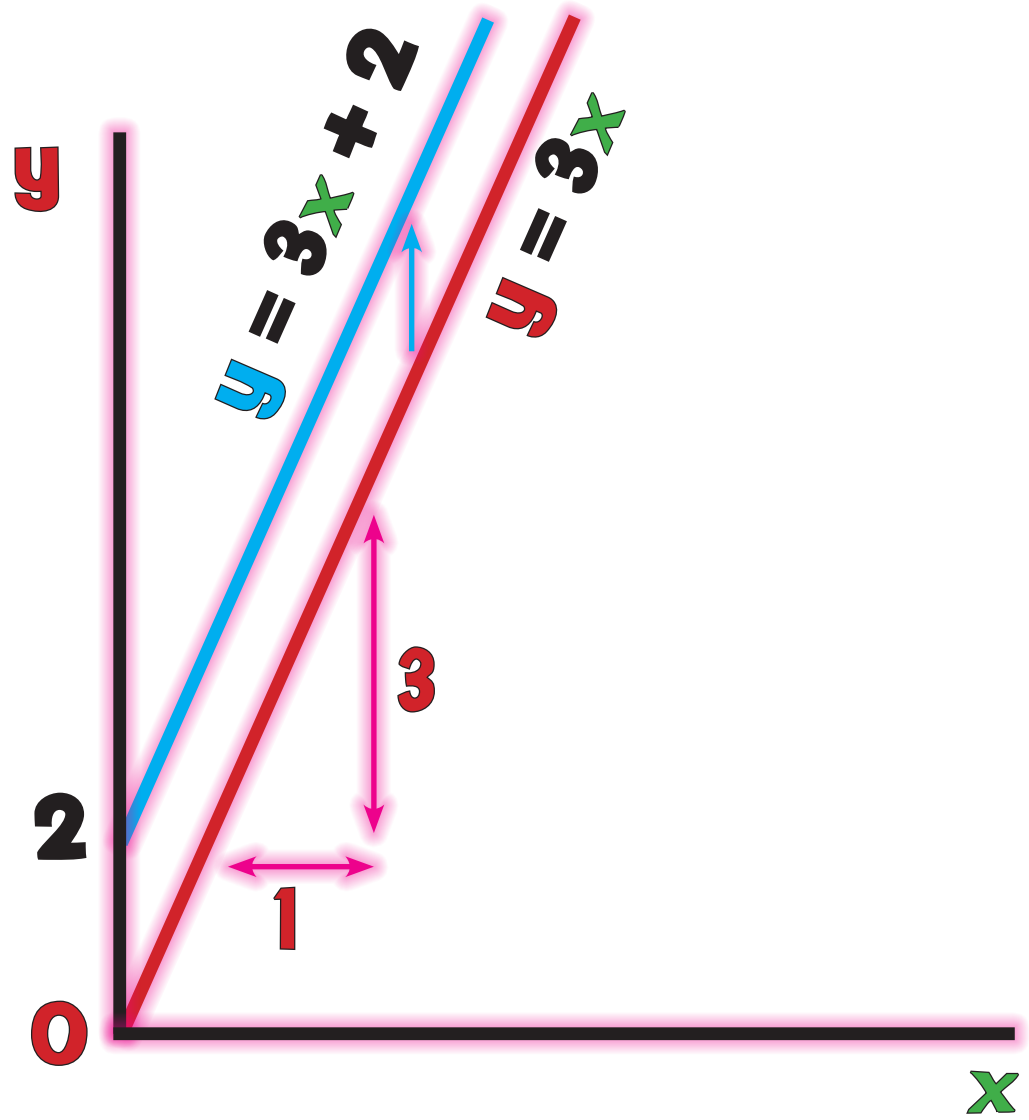
x	0	1	2	3	4	5	→	10	n
y	12	10	8	6	4	2	→		

Counting back in 2's, starting at 10

$$y = -2x + 12$$

AF: Connections

6d

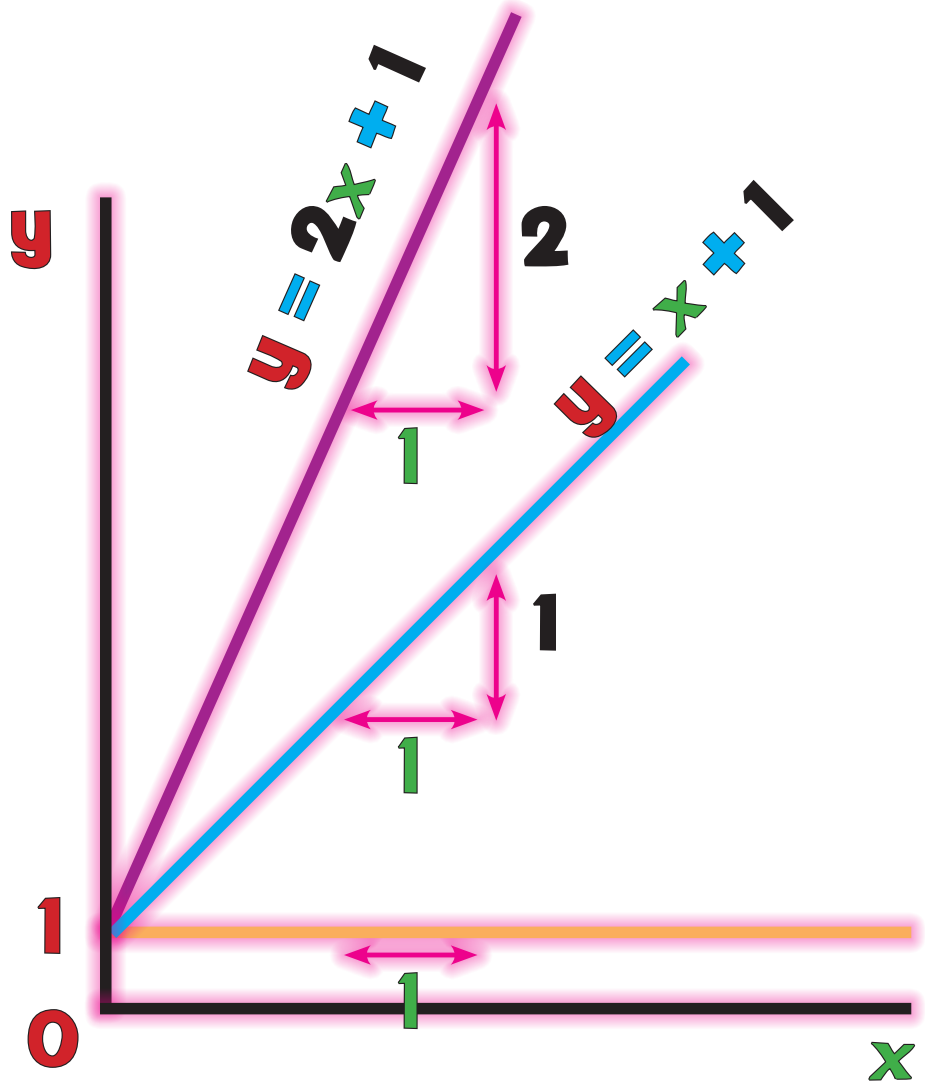


x	1	2	3	4	5	6
y	3	6	9	12	15	18
y + 2	5	8	11	14	17	20

x	x3	y	+2	y
1	→	3	→	5
2	→	6	→	8
3	→	9	→	11
4	→	12	→	14
5	→	15	→	17
6	→	18	→	20

AF: $y = mx + c$

6e



$y = mx + c$

If m is 0, c is 1 : $y = 1$

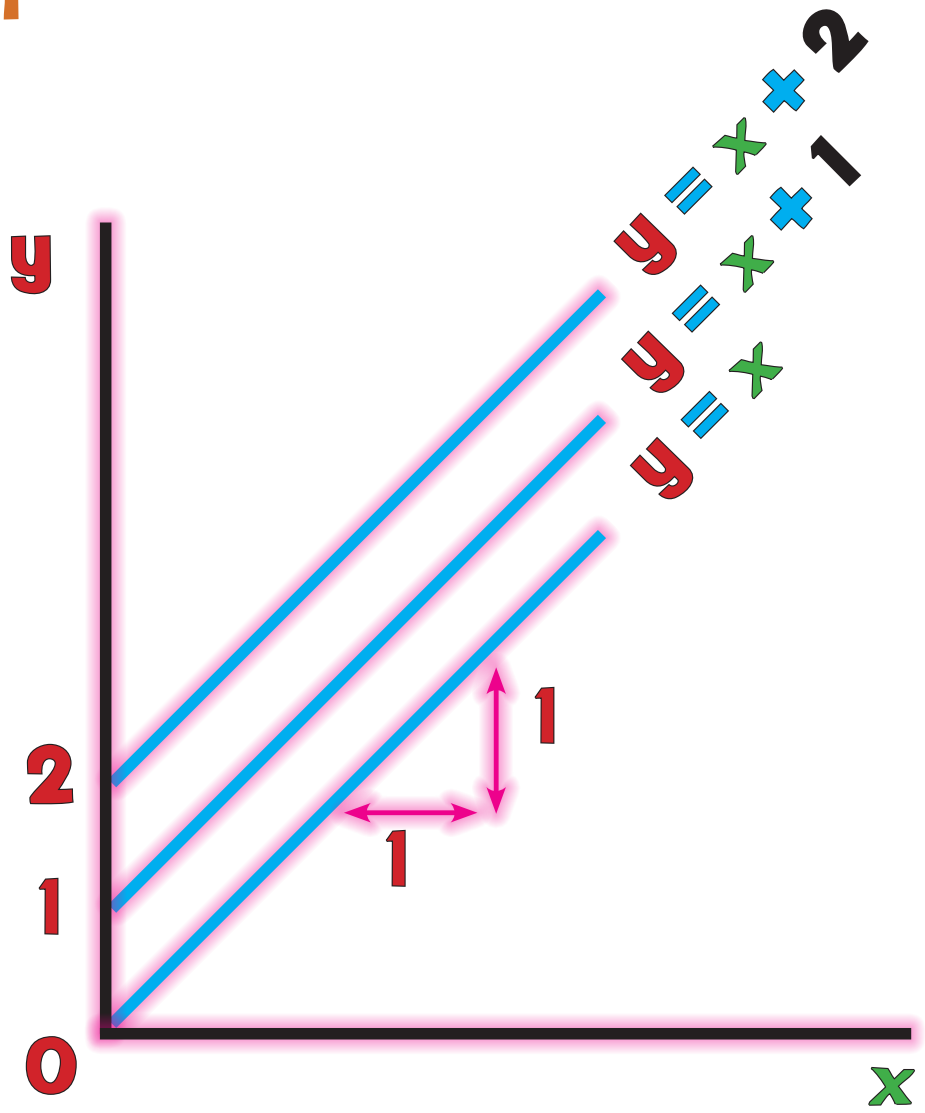
If m is 1, c is 1 : $y = x + 1$

If m is 2, c is 1 : $y = 2x + 1$

m = gradient
c = y intercept, when x is zero (zero term)

AF: y = mx + c

6f



$y = mx + c$

If m is 1, c is 0 : $y = x$

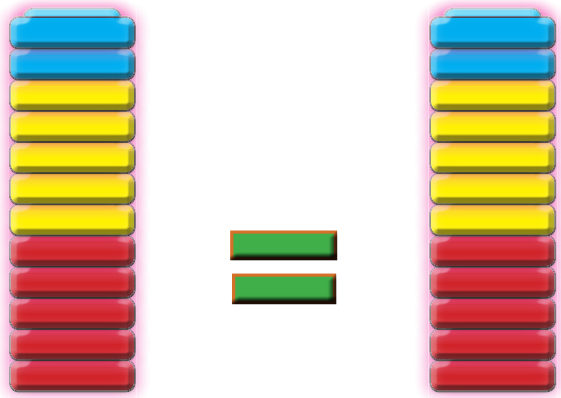
If m is 1, c is 1 : $y = x + 1$

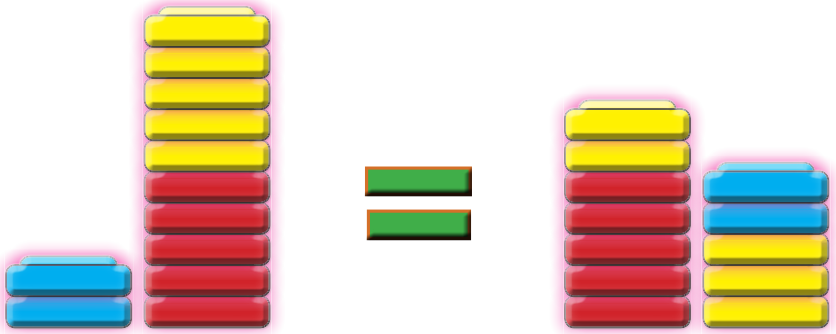
If m is 1, c is 2 : $y = x + 2$

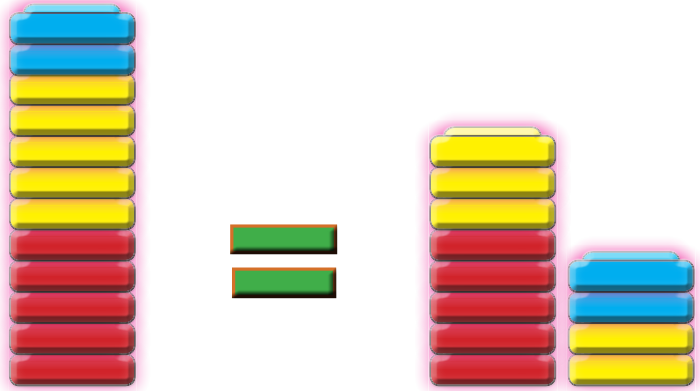
m = gradient
c = y intercept, when x is zero (zero term)

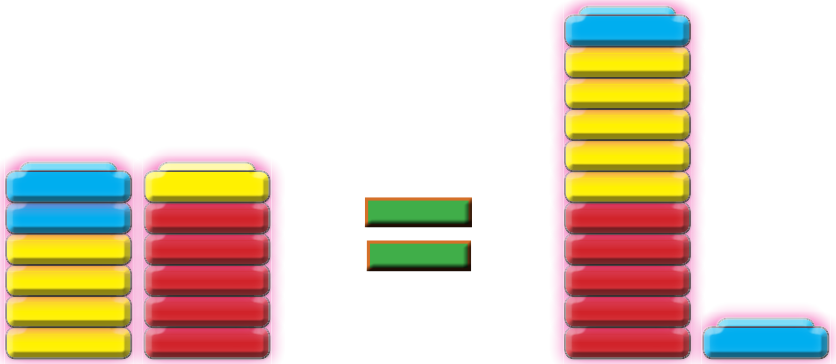
AG: Balancing Stacks

1



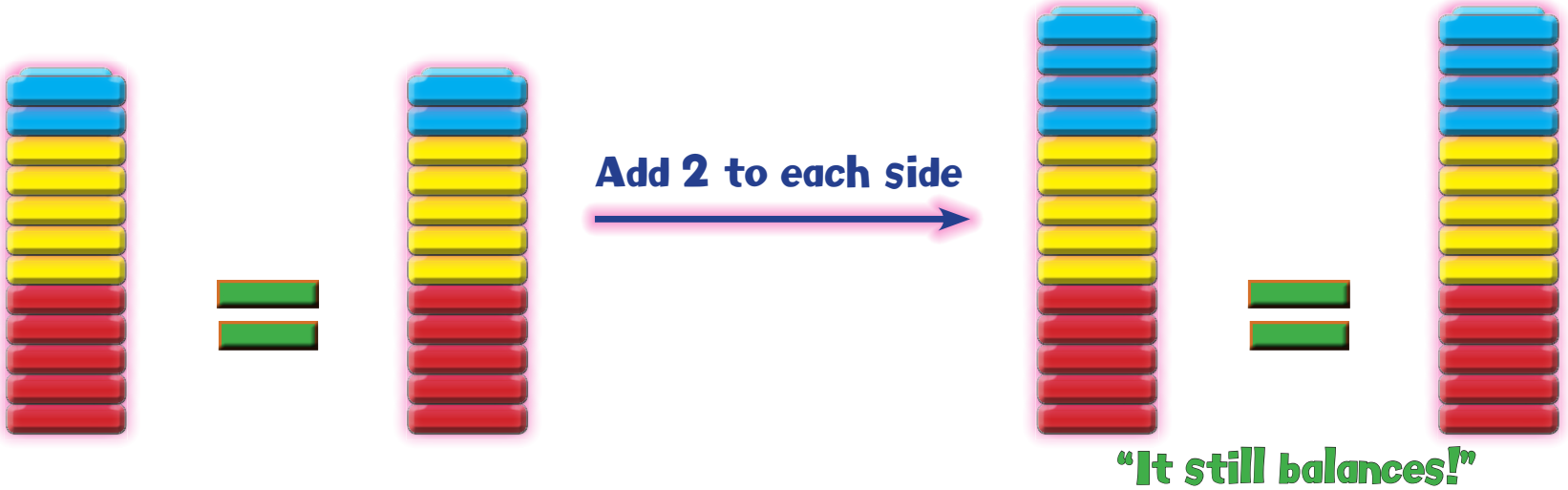


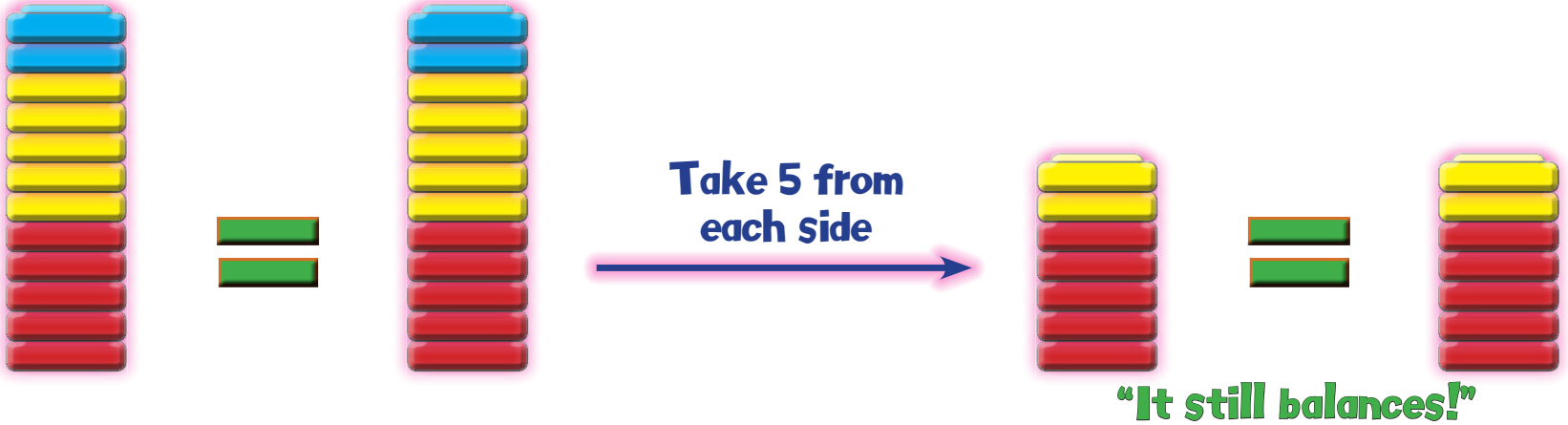




AG: Balancing Stacks

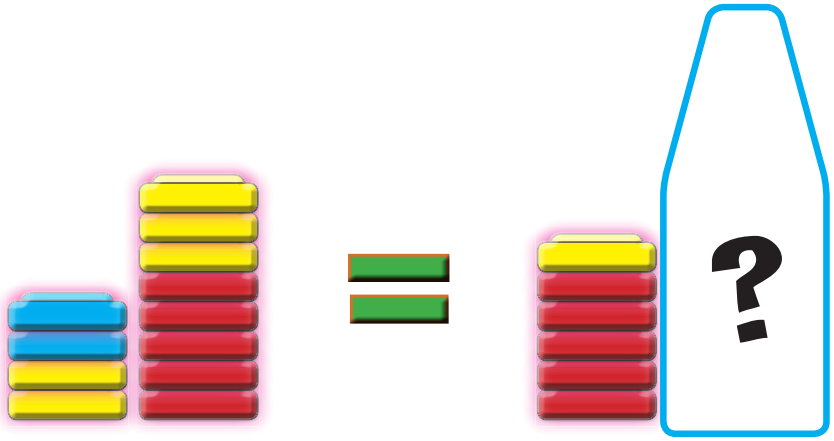
1/2

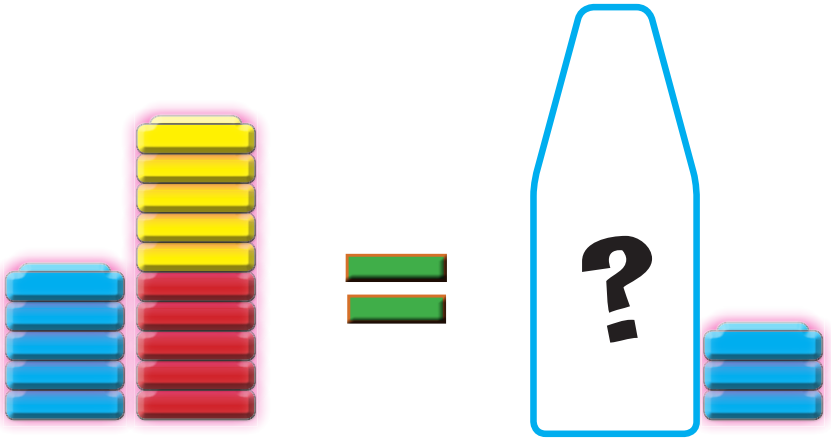


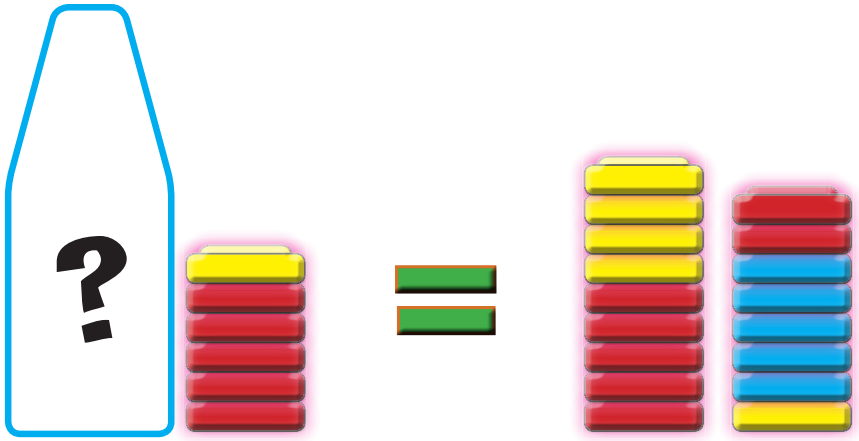


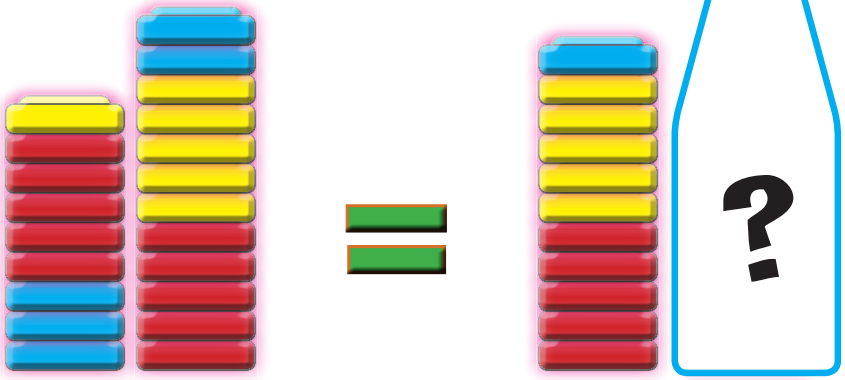
AG: Balancing Stacks

3



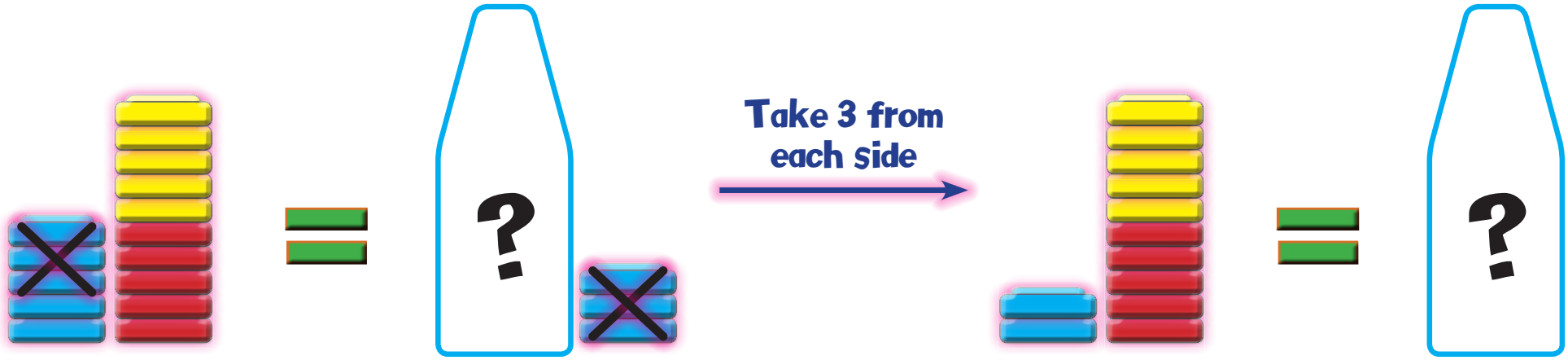


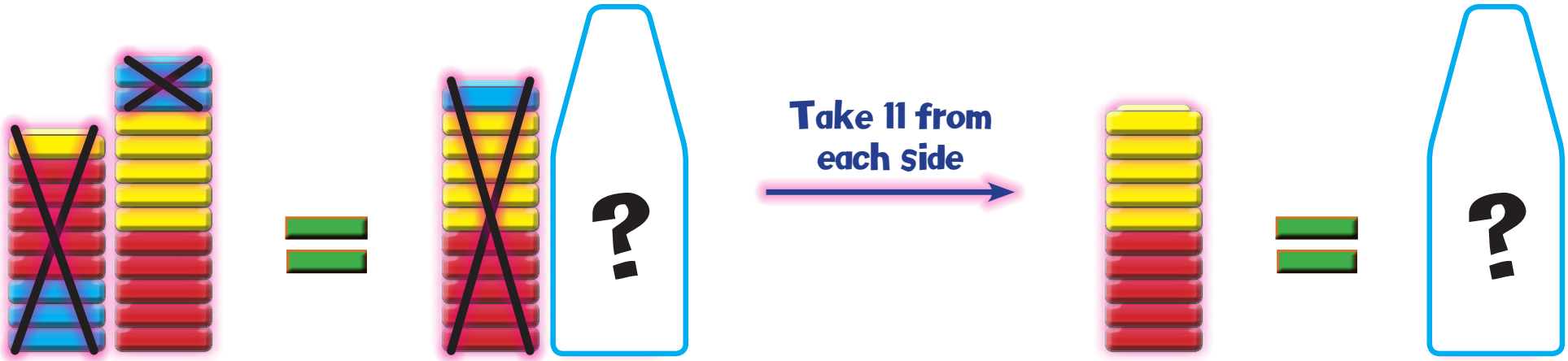




AG: Balancing Stacks

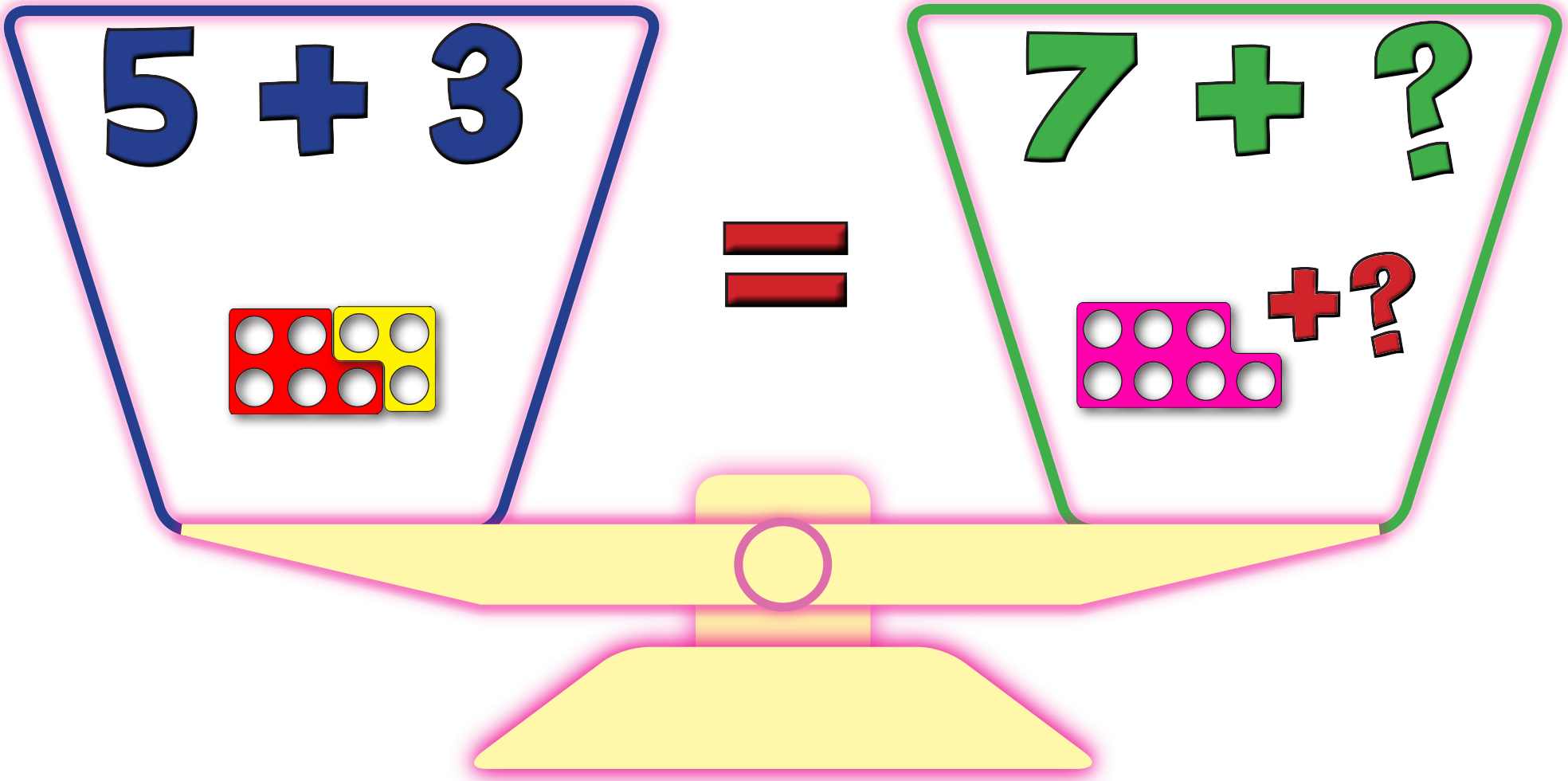
4





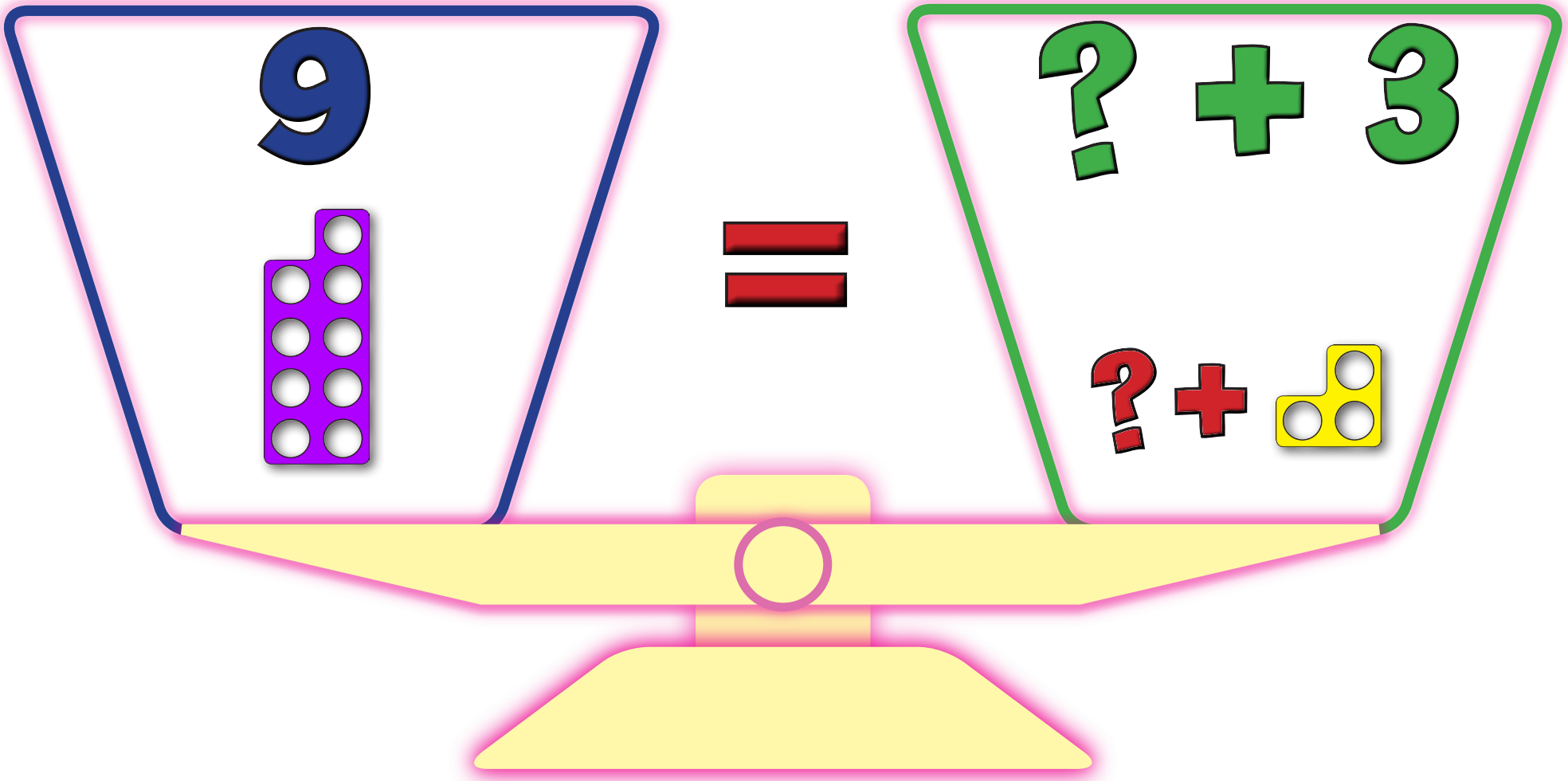
AH: Balancing Equations

1a



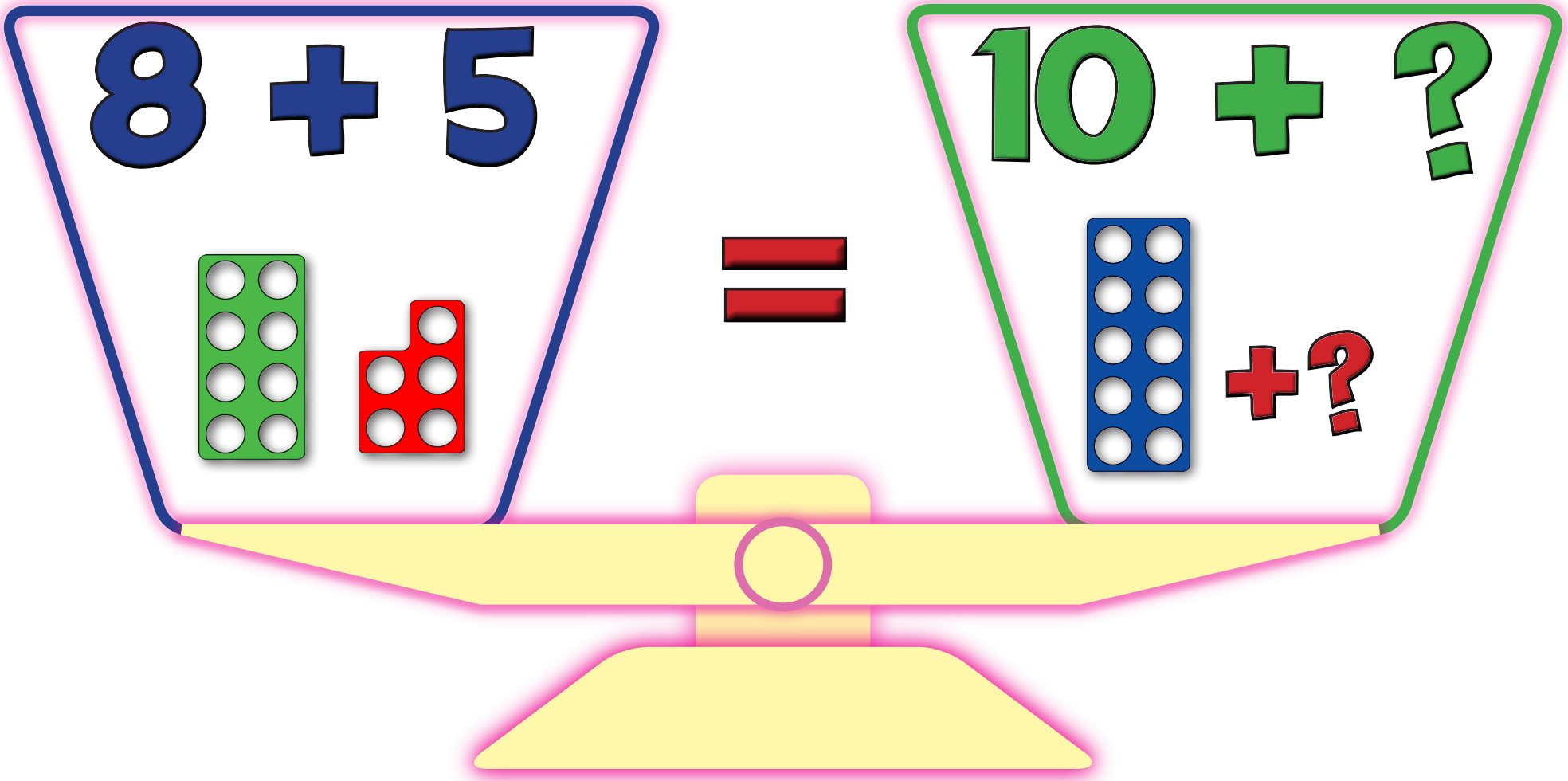
AH: Balancing Equations

1b



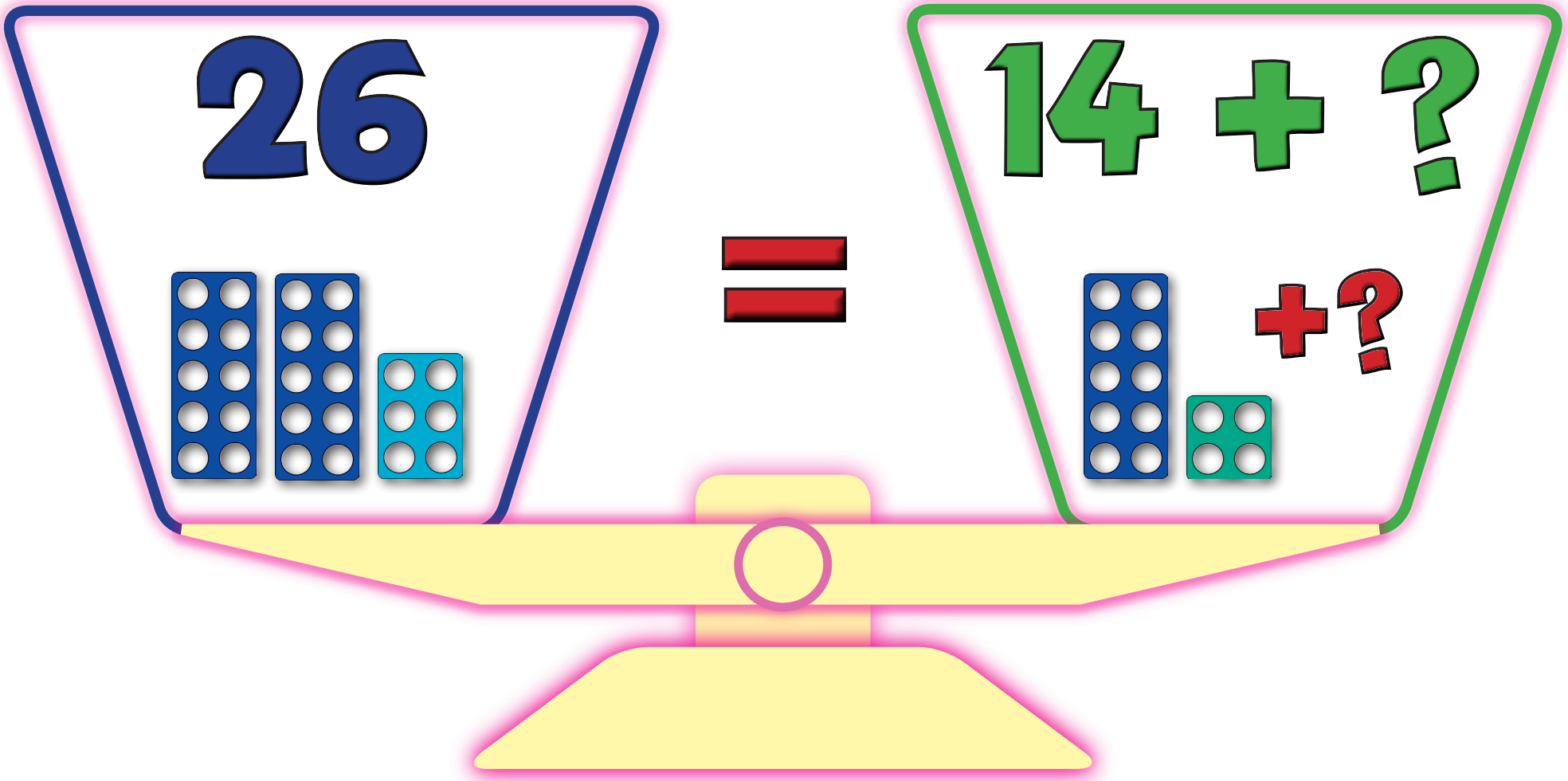
AH: Balancing Equations

1c



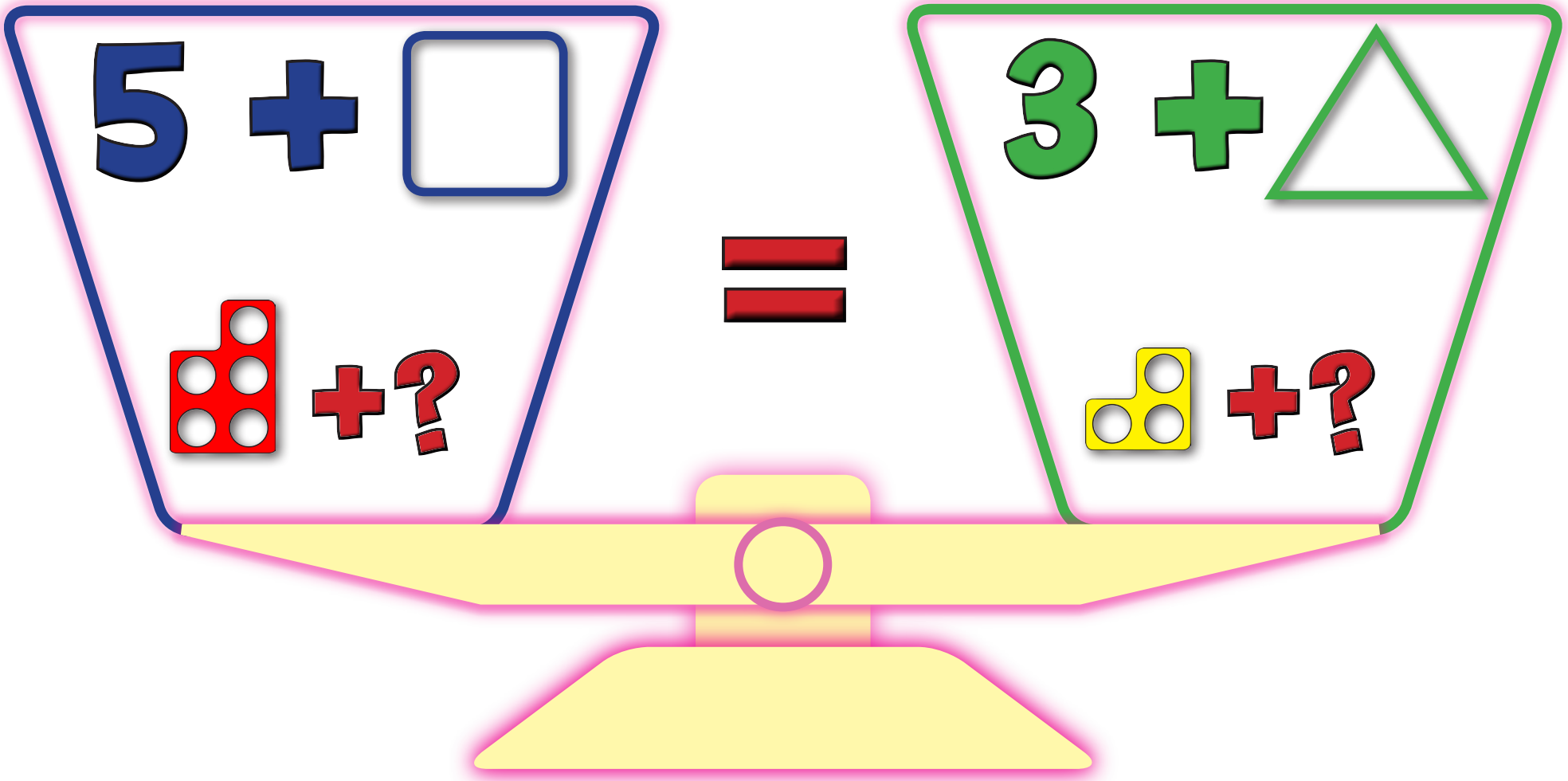
AH: Balancing Equations

2a



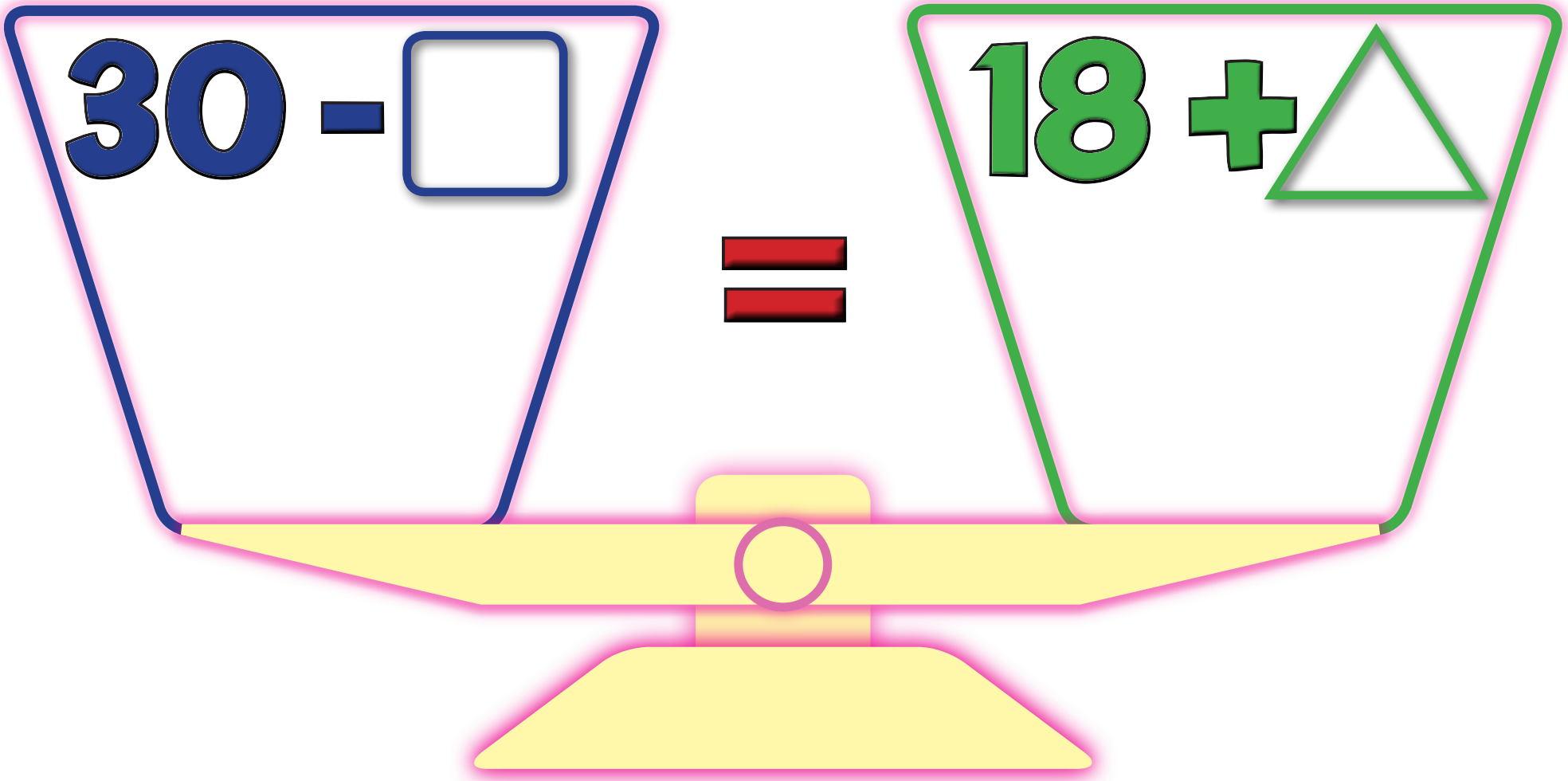
AH: Balancing Equations

2b



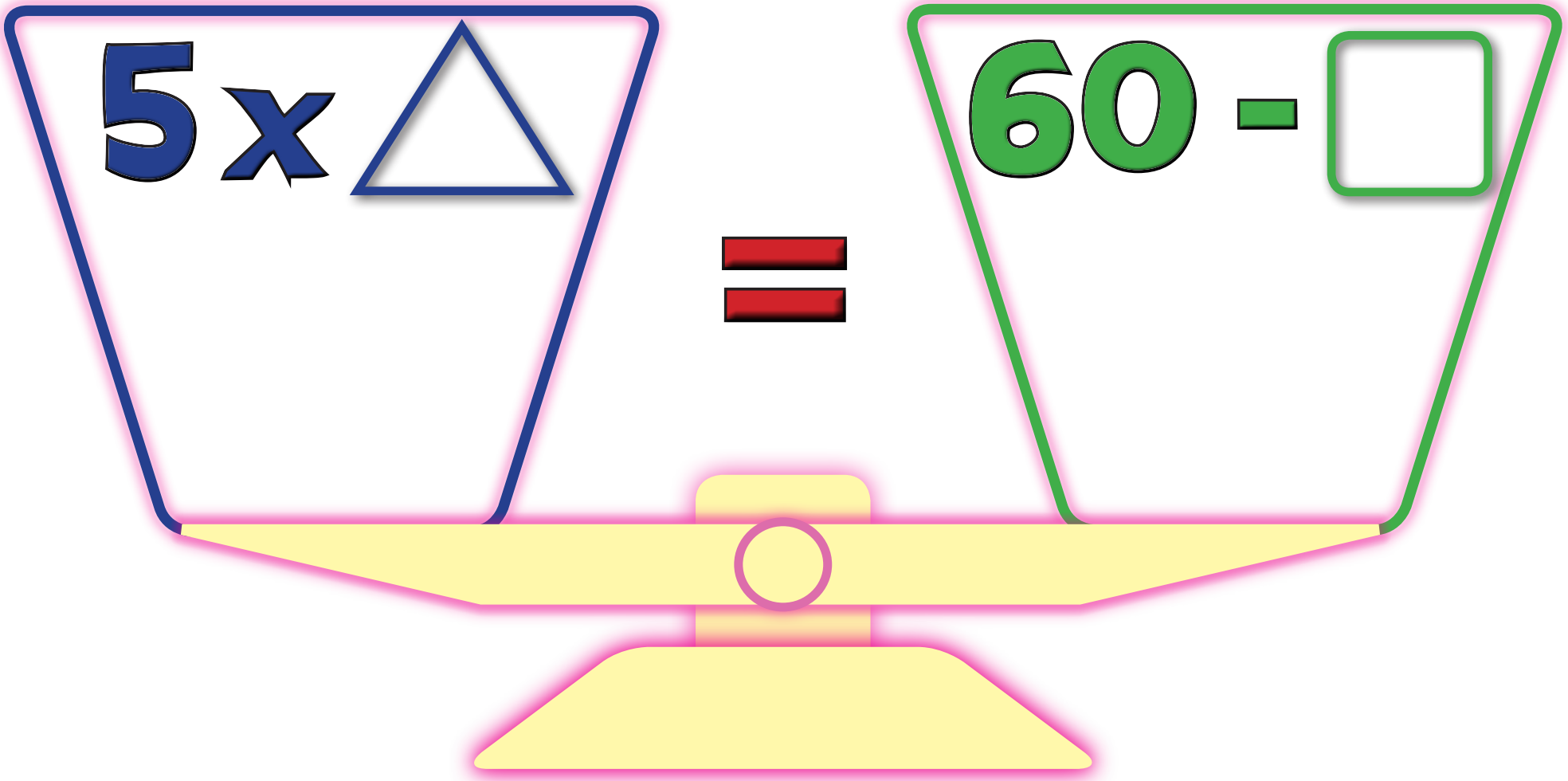
AH: Balancing Equations

3



AH: Balancing Equations

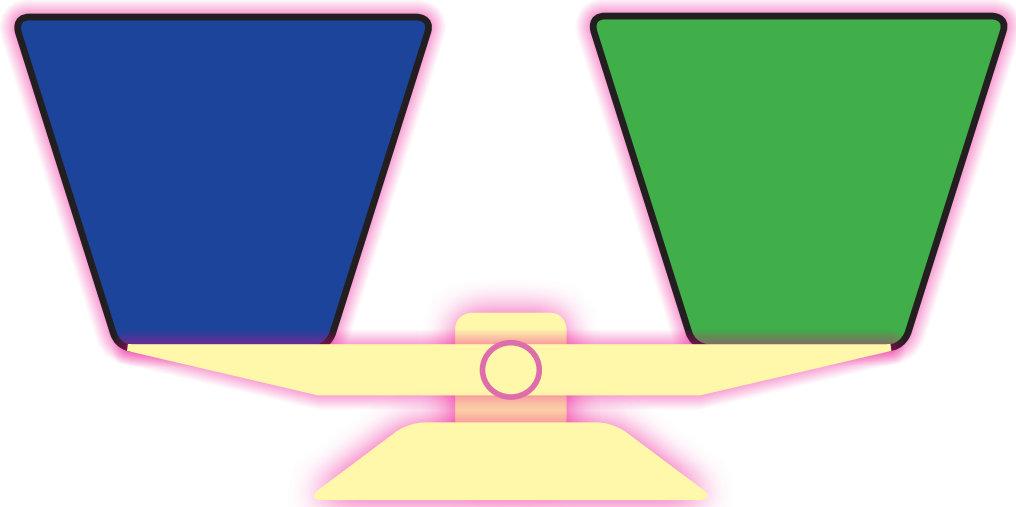
3/4



AH: Balancing Equations

5a

$(10 \times \triangle) + 4 = 80 - \square$



AH: Balancing Equations

5b

$(20 \times \triangle) + 30 = 90 - (10 \times \square)$

AH: Balancing Equations

5c

$$5n + 10 = 58 - n$$

AH: Balancing Linear Equations

6a Algebraic Notation

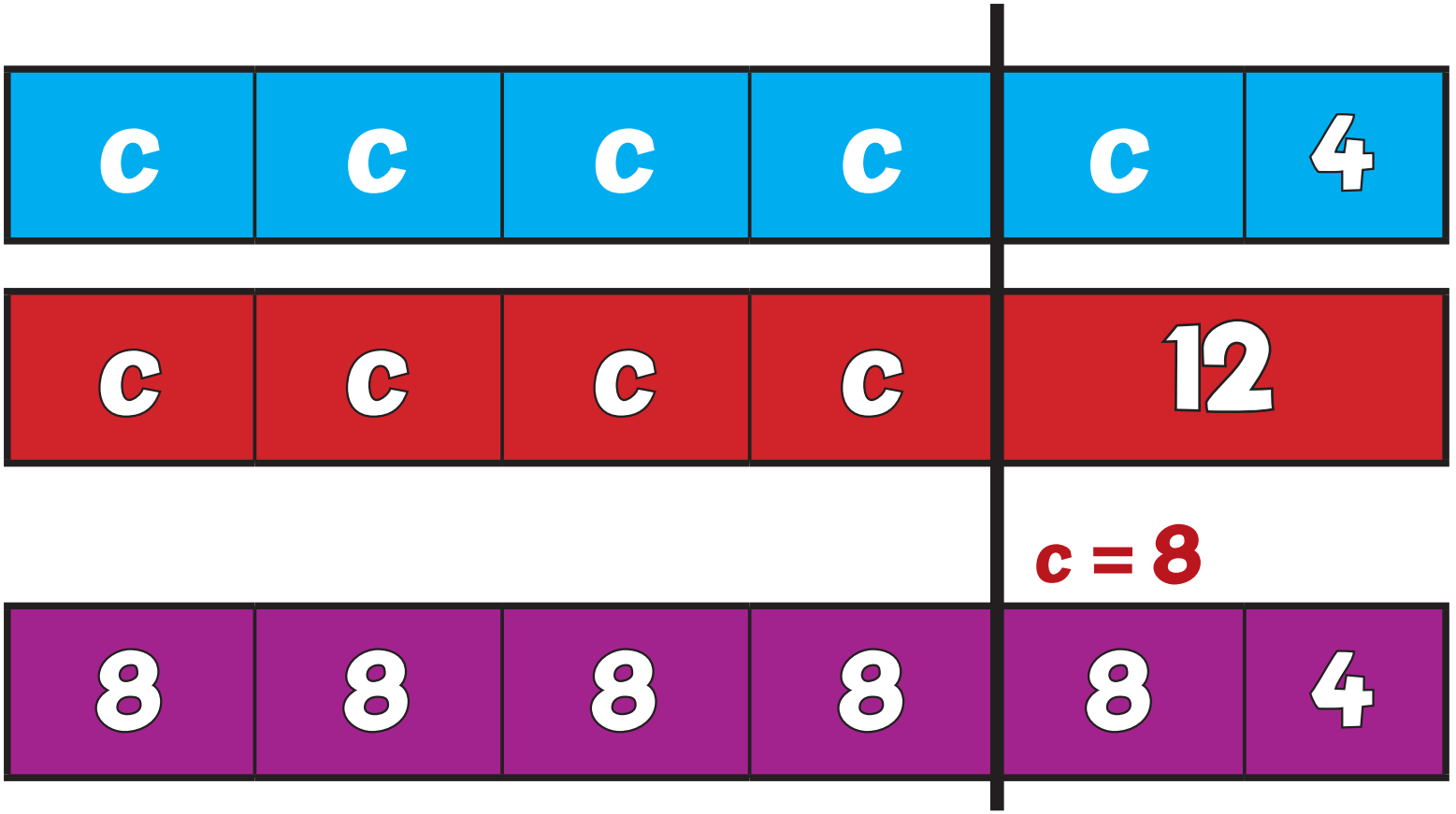
$$5c + 4 = 4c + 12$$
$$-4 \qquad\quad -4$$
$$5c = 4c + 8$$
$$-4c \qquad -4c$$
$$c = 8$$

AH: Balancing Linear Eqns.

6b

Bar Model

$$5c + 4 = 4c + 12$$



AH: Balancing Linear Equations

6c

Algebraic Notation

$$5x + 6 = 22 + x$$
$$-x \qquad\qquad -x$$
$$4x + 6 = 22$$
$$-6 \qquad -6$$
$$4x = 16$$
$$\div 4 \qquad \div 4$$
$$x = 4$$

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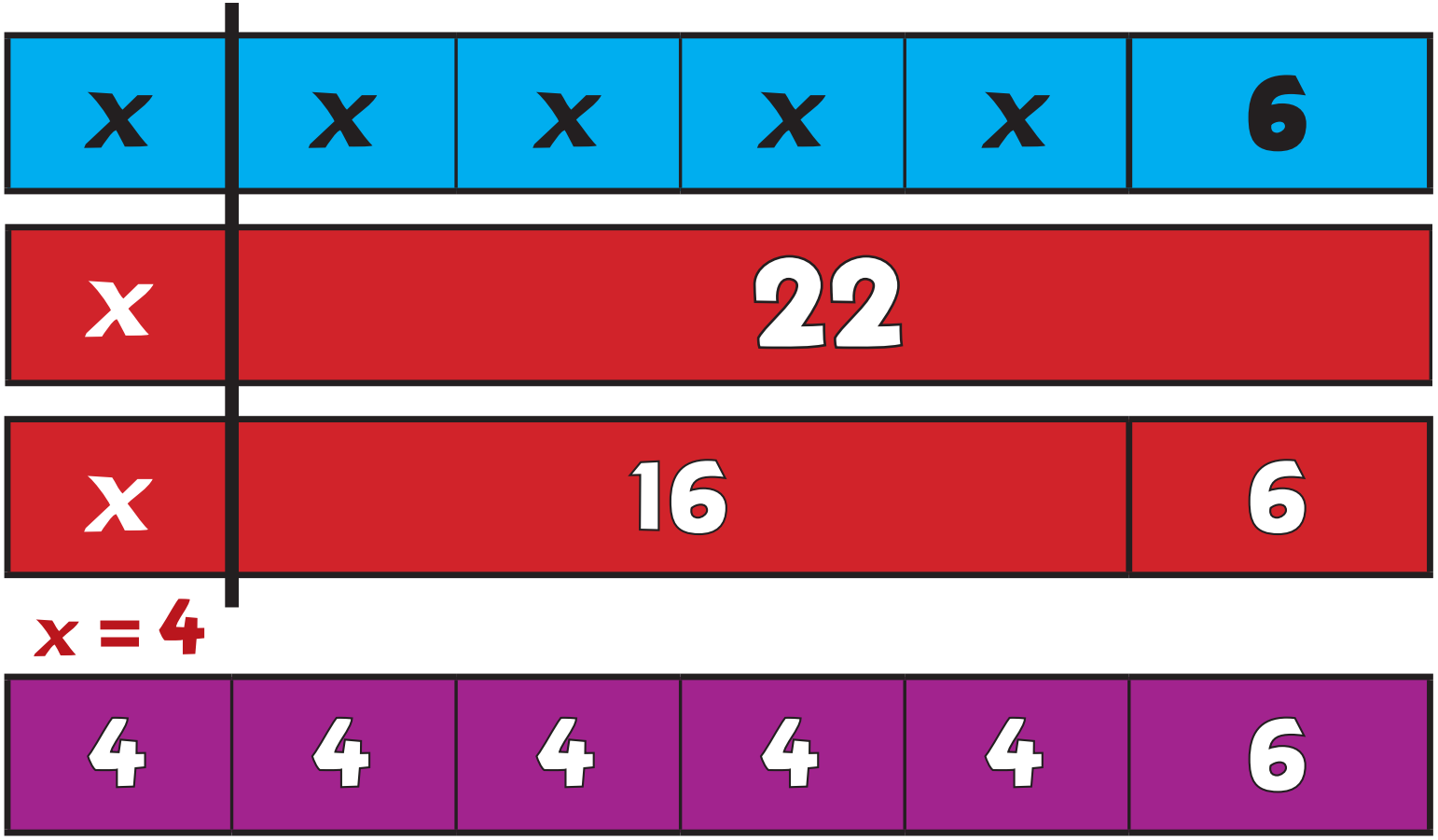
AF: Balancing Linear Eqns.

6d

Bar Model

$$5x + 6 = 22 + x$$



AH: Balancing Linear Equations

6e

Algebraic Notation

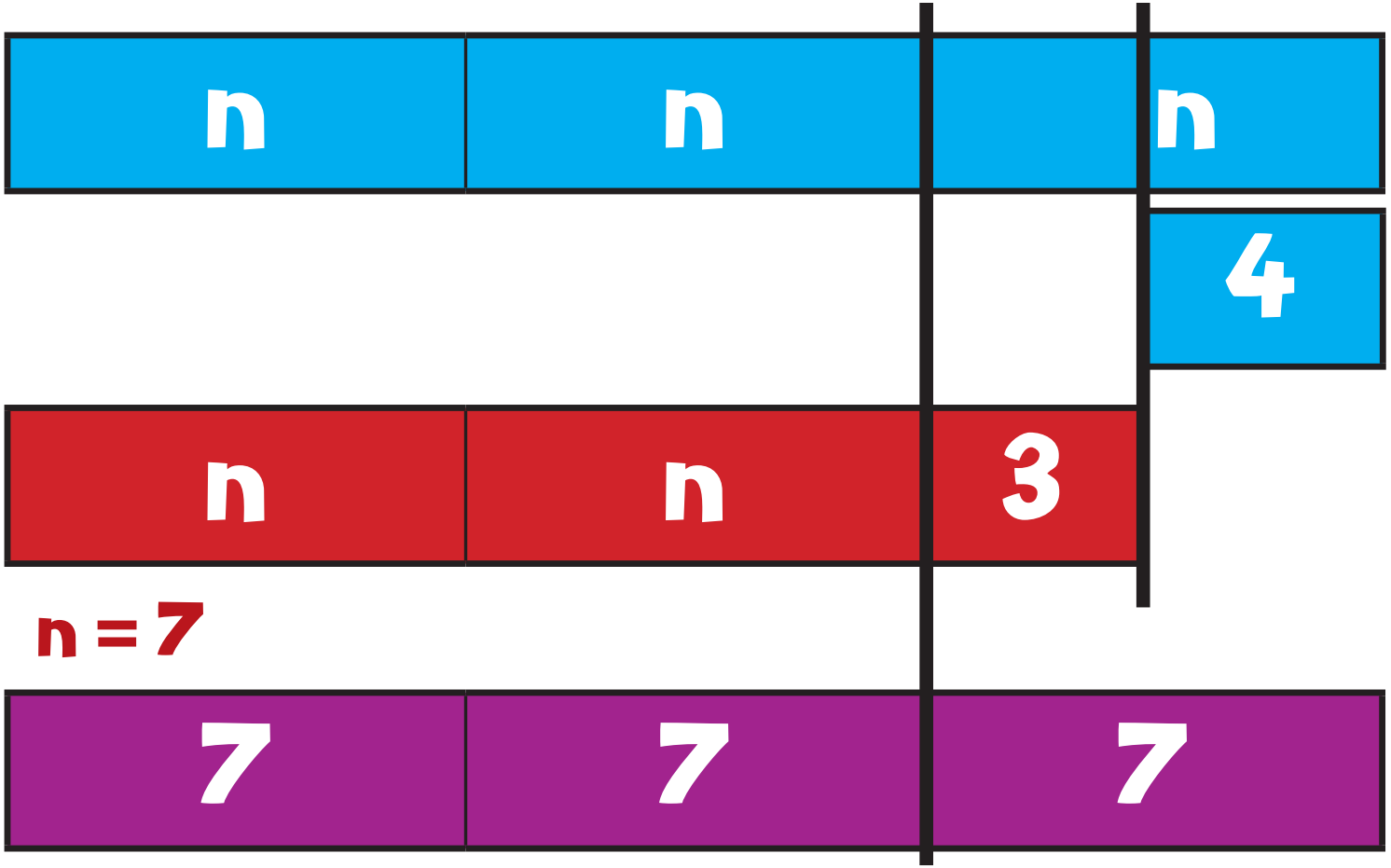
$$3n - 4 = 2n + 3$$
$$+4 \qquad +4$$
$$3n = 2n + 7$$
$$-2n \qquad -2n$$
$$n = 7$$

AH: Balancing Linear Equations

6f

Bar Model

$$3n - 4 = 2n + 3$$



AH: Balancing Linear Equations

6g

Algebraic Notation

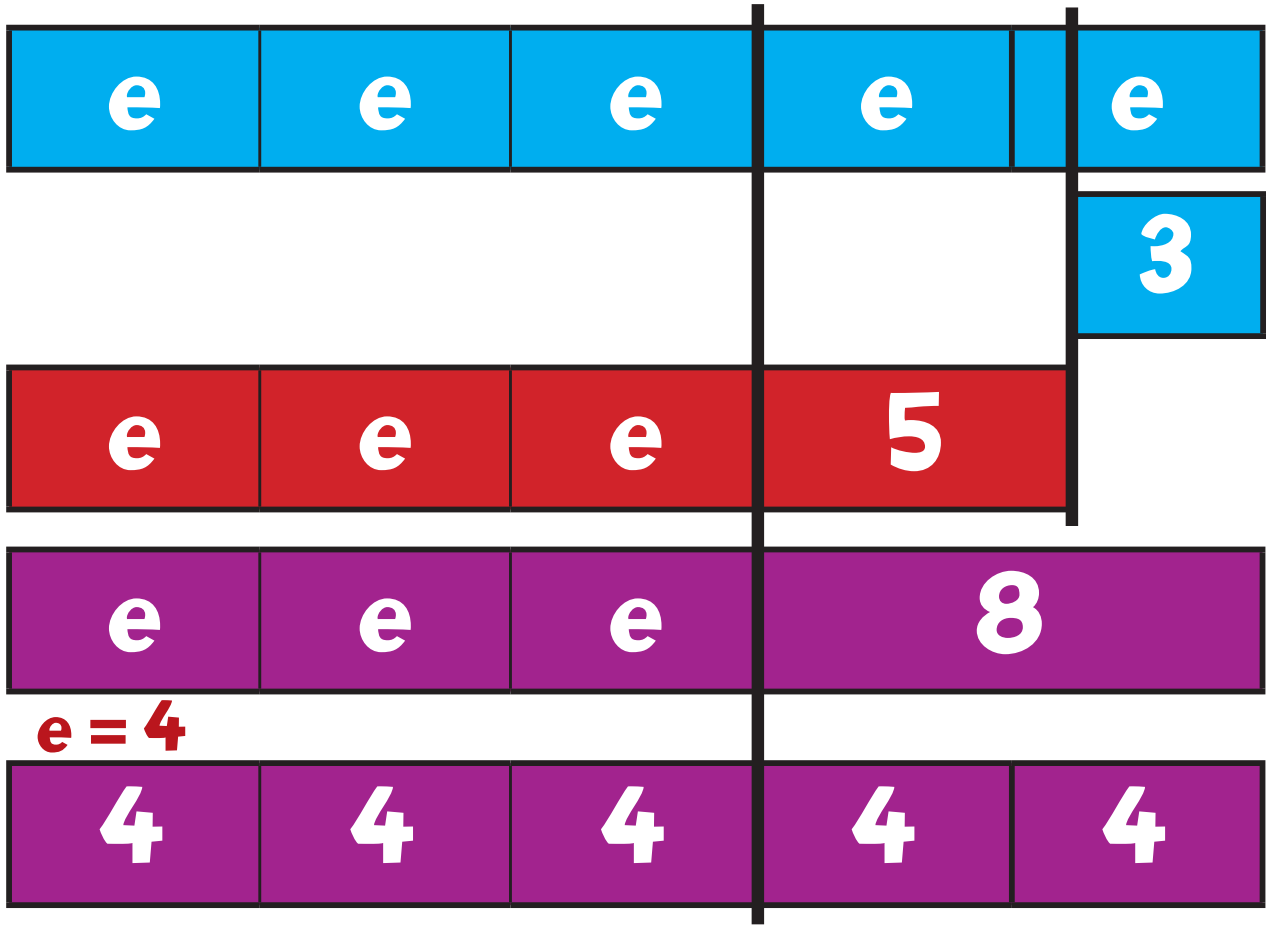
$$5e - 3 = 3e + 5$$
$$+3 \qquad +3$$
$$5e = 3e + 8$$
$$-3e \qquad -3e$$
$$2e = 8$$
$$\div 2 \qquad \div 2$$
$$e = 4$$

AH: Balancing Linear Equations

6h

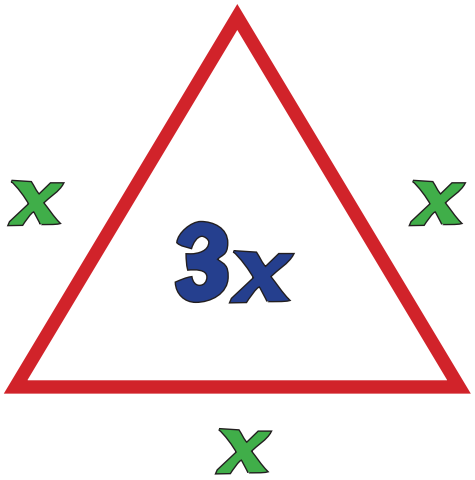
Bar Model

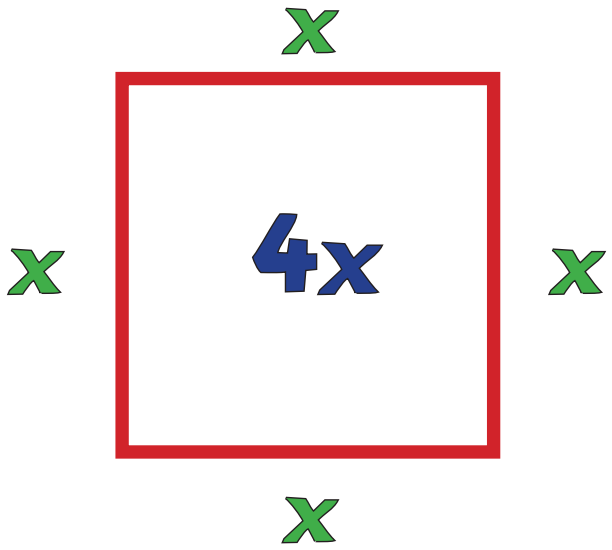
$$5e - 3 = 3e + 5$$

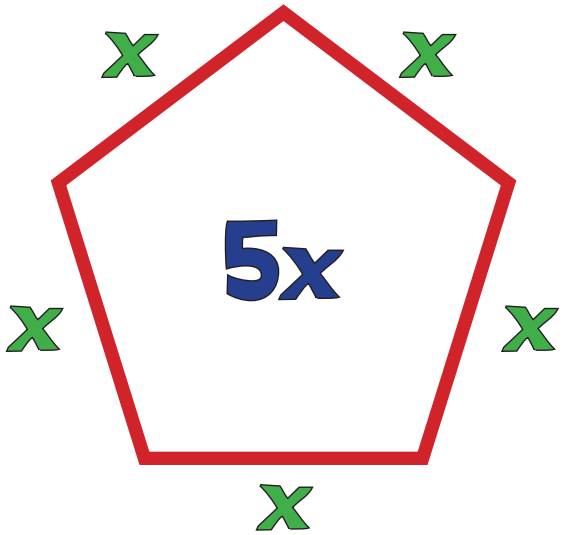


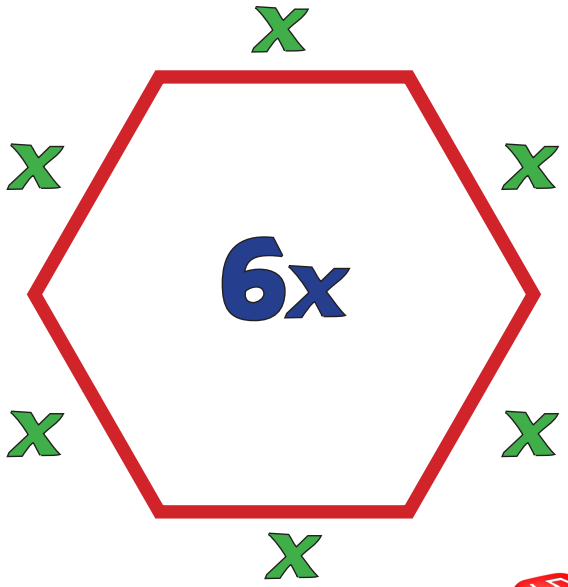
A1: Formulae (Perimeter)

4a



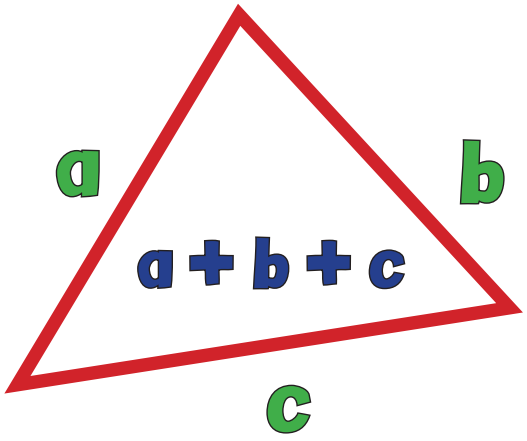


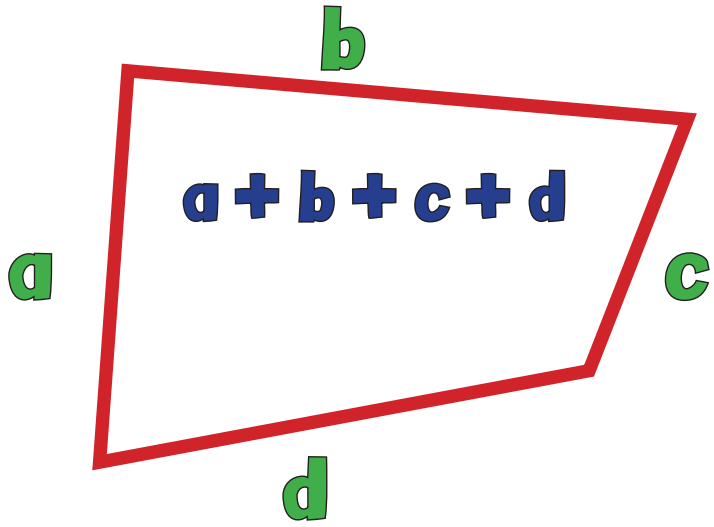


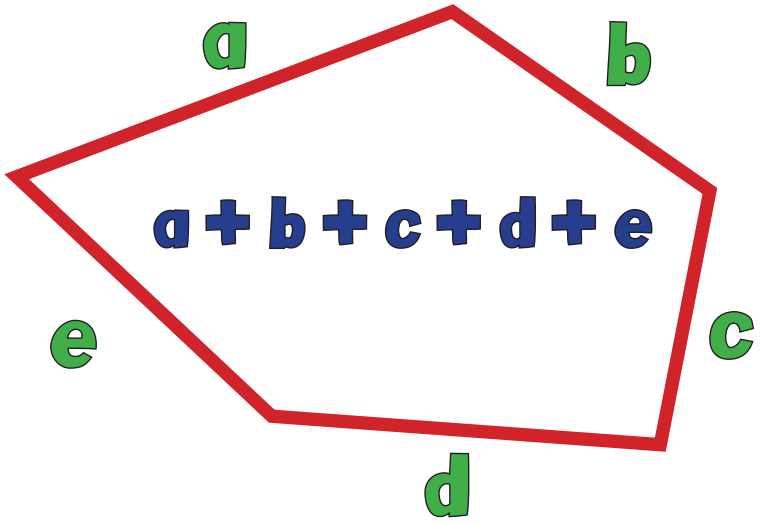


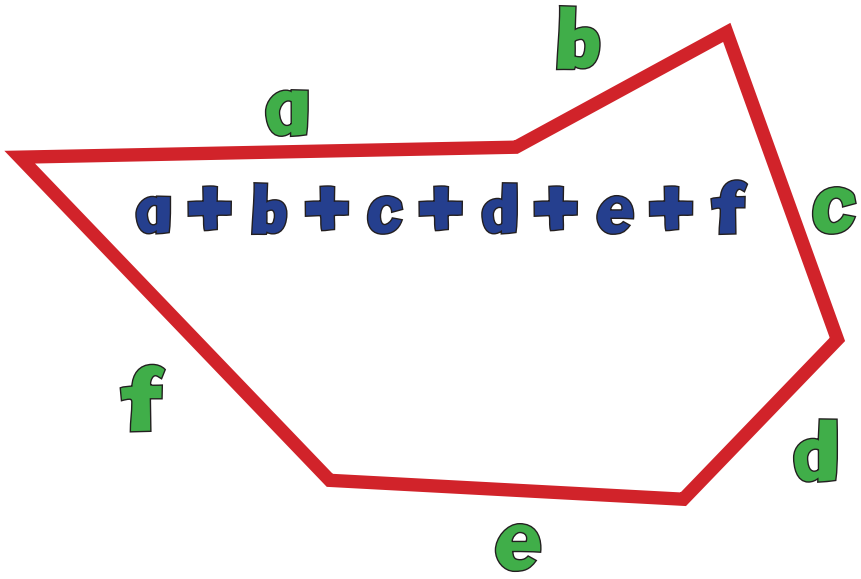
A1: Formulae (Perimeter)

4b



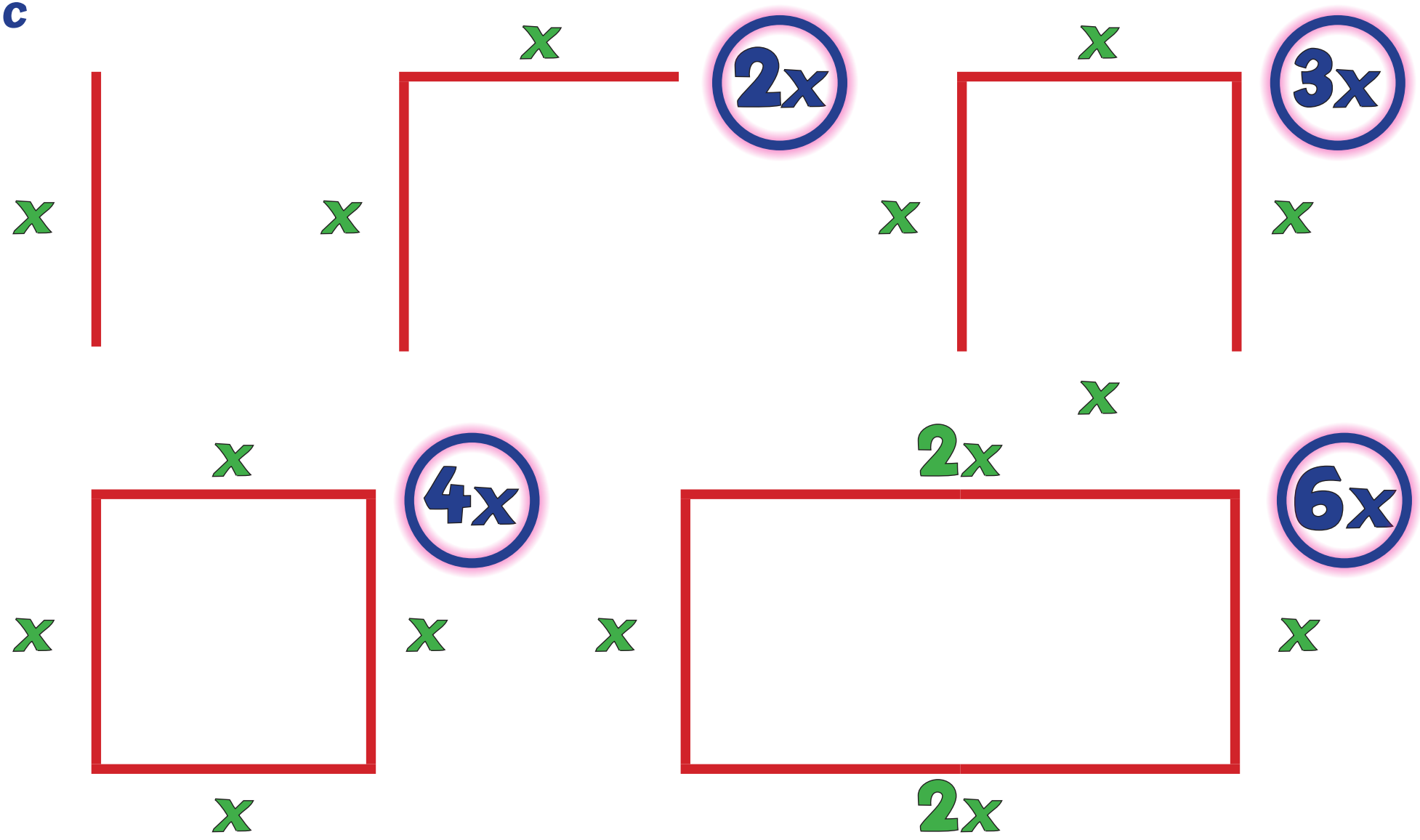






A1: Formulae (Perimeter)

4c



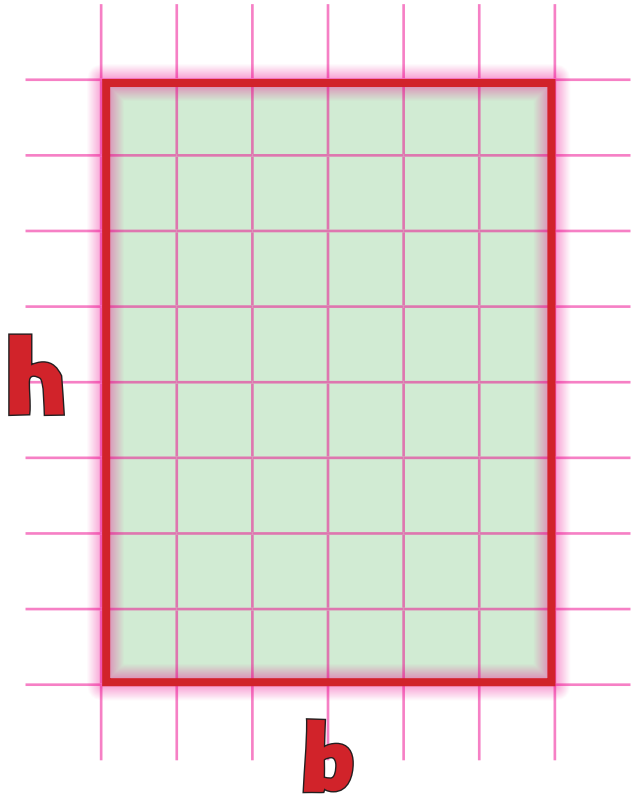
A1: Formulae (Area)

b = base
h = height

5

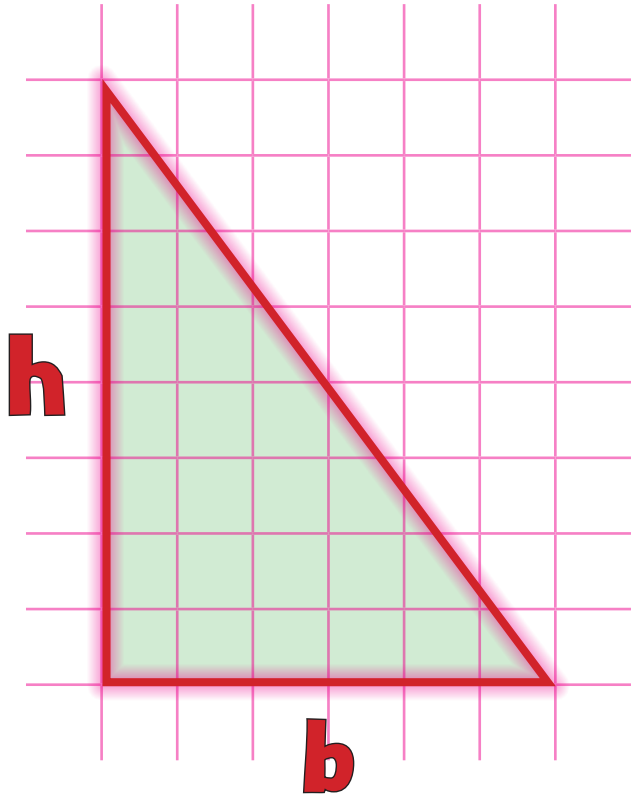
Area of a Rectangle

$= b \times h$



Area of a Triangle

$= \frac{1}{2} \times b \times h$



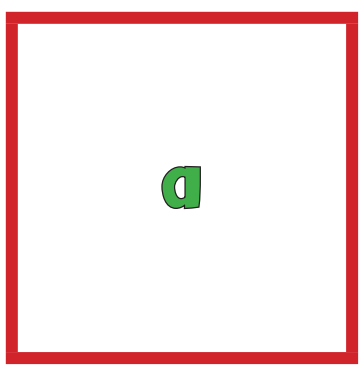
b = 6cm
h = 8cm

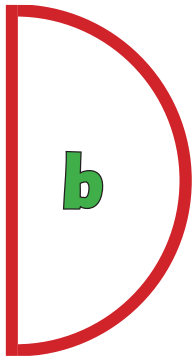
Area = 6cm x 8cm = 48cm²

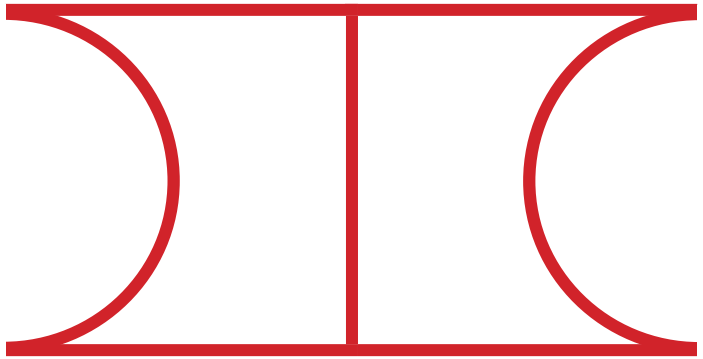
Area = 0.5 x 6cm x 8cm = 24cm²

A1: Formulae (General)

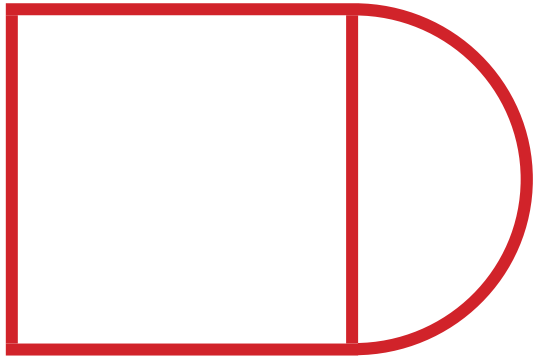
5/6



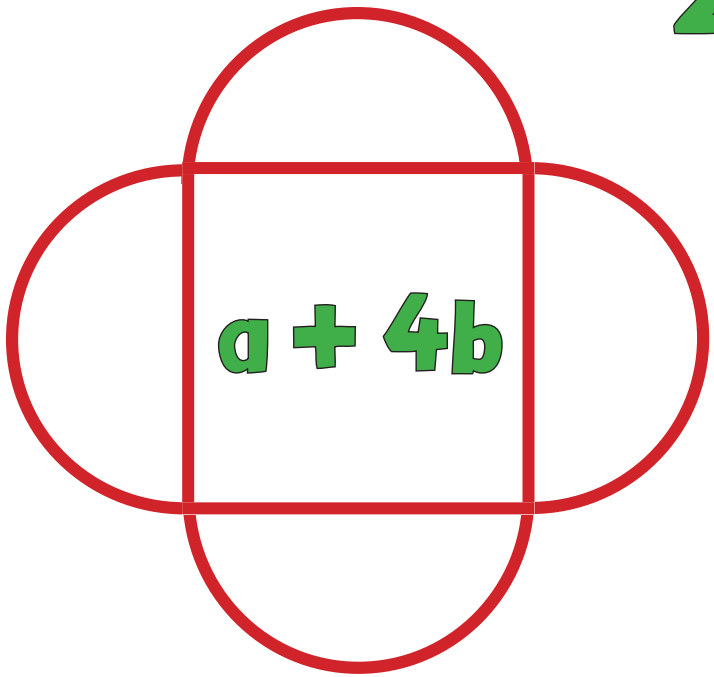


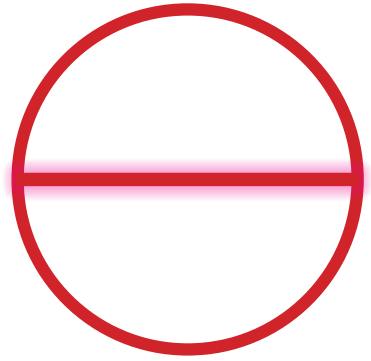


2a - 2b



a + b

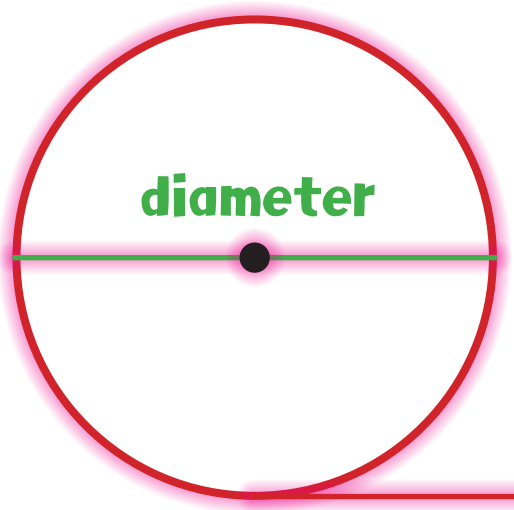




2b

A1: The Pi (π) you can't eat!

6

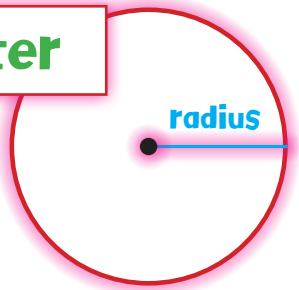


π (Pi) is the ratio of a circle's circumference to its diameter!

$$\pi = \frac{\text{circumference}}{\text{diameter}}$$

Circumference = 3.141592653590 x Diameter

radius = $\frac{1}{2}$ x diameter



Area of a Circle = π x r x r = πr^2

Circumference of a Circle = $2\pi r = \pi d$

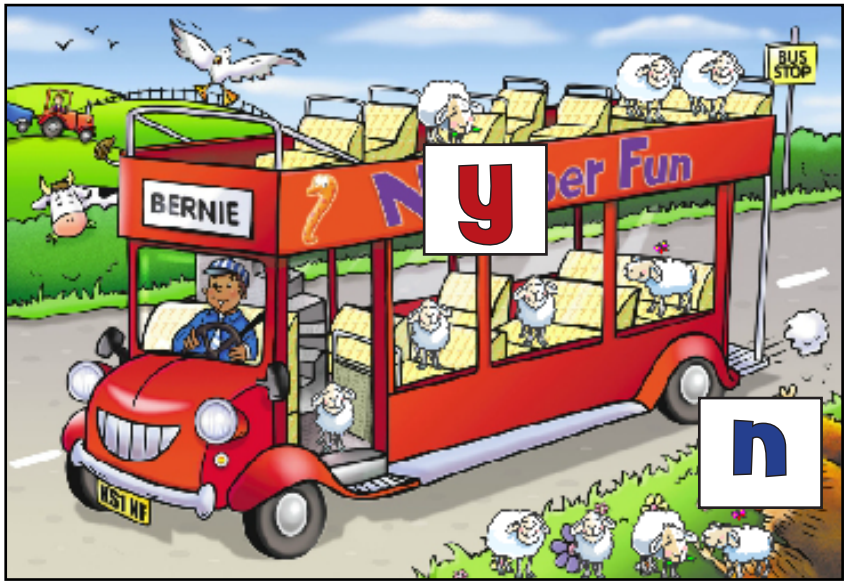
AJ: Algebra Word Problems

5/6a

Suppose there are y sheep on a bus. At a bus stop n more sheep get on the bus.

How many sheep are now on the bus?

Answer: y + n



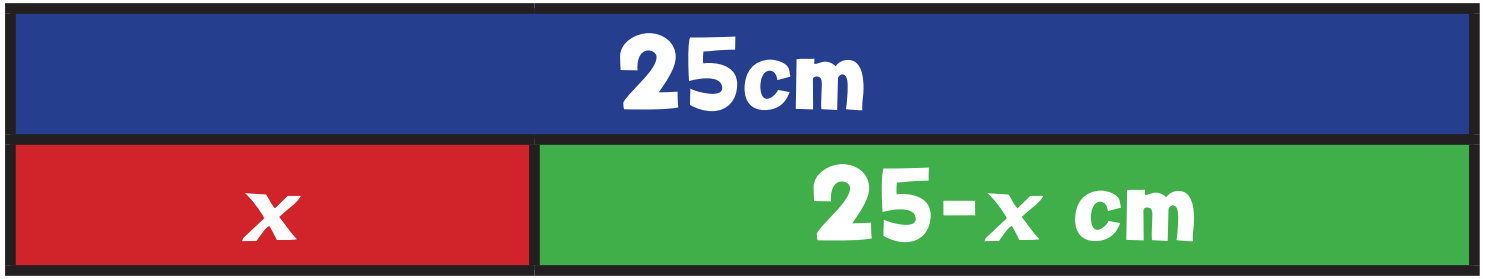
AJ: Algebra Word Problems

5/6b

A piece of wood is 25 cm long.

How much remains after I cut off a piece with length x cm?

Answer: 25 - x cm



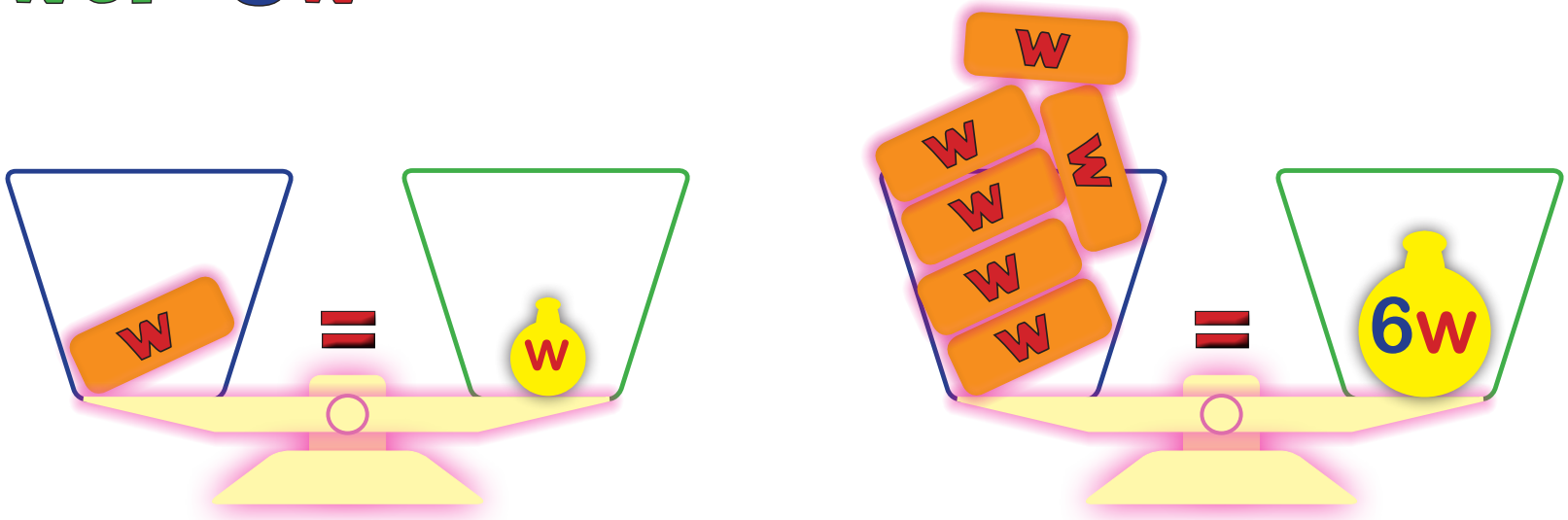
AJ: Algebra Word Problems

5/6c

A brick weighs w kg.

How much do six bricks weigh?

Answer: 6w



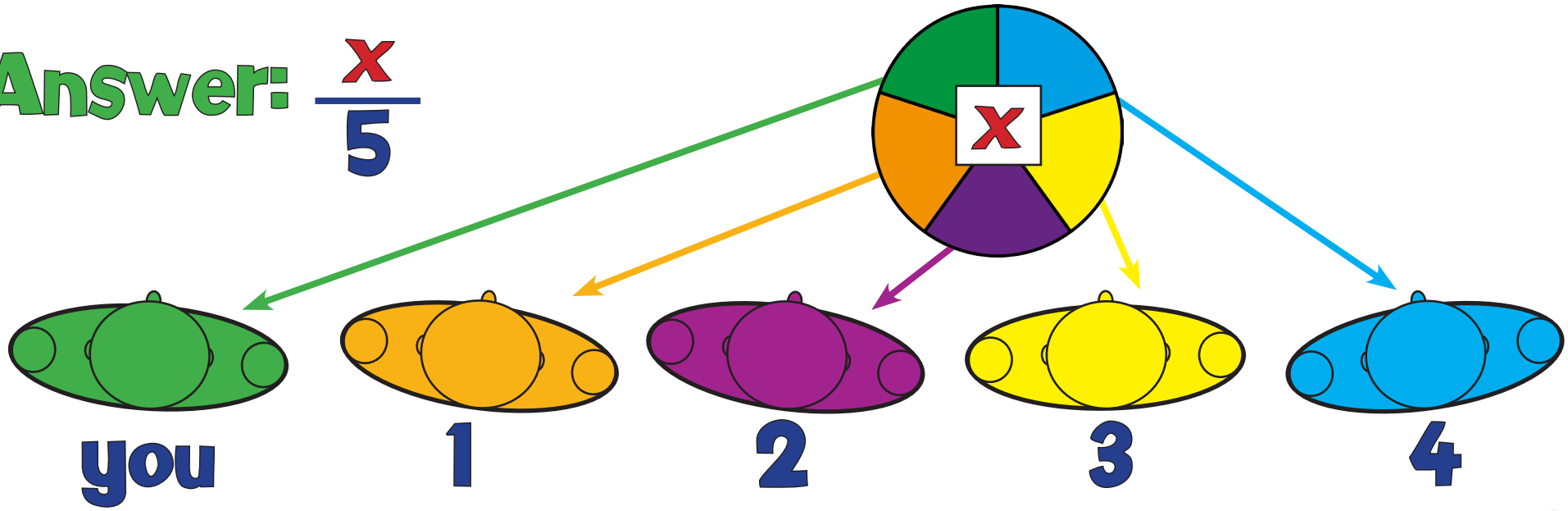
AJ: Algebra Word Problems

5/6d

A prize of x is shared equally between you and four others.

How much does each person recieve?

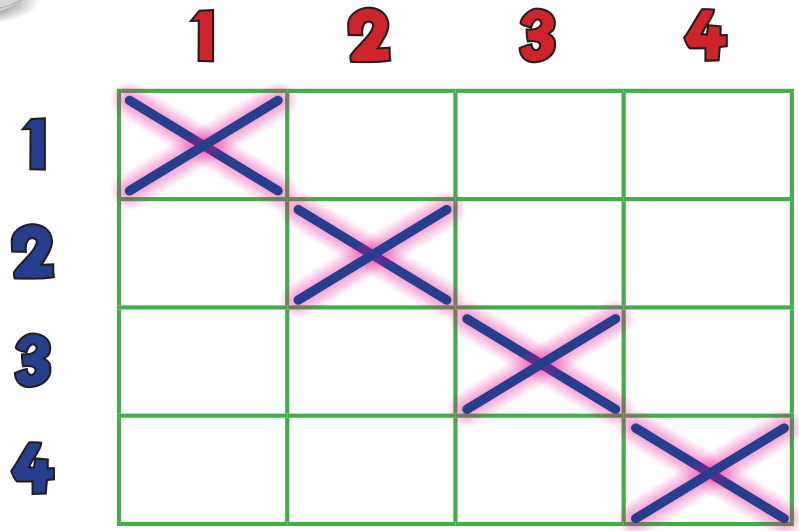
Answer: $\frac{x}{5}$



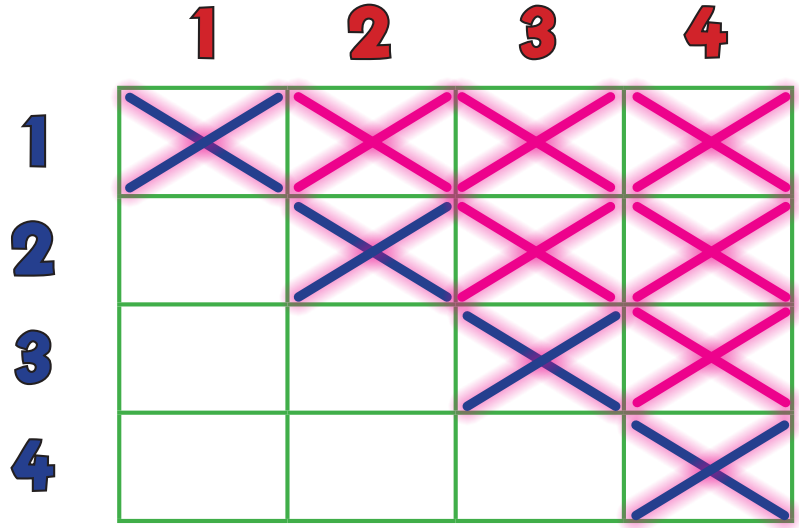
AJ: Algebra Problem Solving

5/6e

4 football teams were in a league together, and played each other once. How many fixtures were there?



Each team can't play themselves. Home and Away fixtures for n teams: $n \times (n-1) = n(n-1)$



Each team plays each other once. Total fixtures for n teams:

$$\frac{n \times (n-1)}{2} = \frac{n(n-1)}{2}$$