XAVIER JR. HIGH

NAME:_____Class:_____

Teacher: Mrs. J. Bennett or Mr. Sheppard (circle)

Grade 8

MATHEMATICS

Things to Know Booklet

Unit	Pages
Unit 1: Powers	
Unit 2: Integers	
Unit 3: Fractions	
Unit 4: Prisms and Cylinders	
Unit 5: Percent, Ratio and Rates	
Unit 6: Linear Equations and graphing	
Unit 7: Data Analysis and Probability	
Unit 8: Geometry and Tessellations	

BEDMAS

L → R L → R

B Brackets

E Exponents

DM $\div$ *or* $\times$ *L to R*

AS $+$ *or* $-$ *L to R*

Unit 1 POWERS $7^2 = 49$

Base 7

Exponent 2

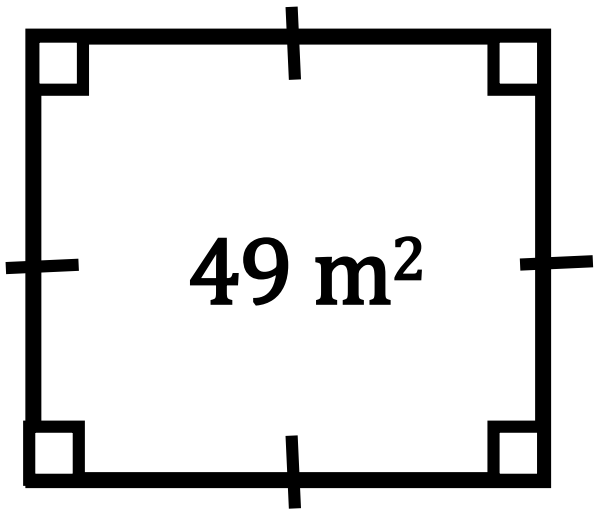
Perfect square 49

Power 7^2

sidelength AREA

Ex. $(7)^2 = 49$

$\sqrt{49} = 7$ m



POWERS

12^2

$= 12 \times 12$

$= 144$

$(1.2)^2$

$=1.2 \text{ x } 1.2$

$= 1.44$

ROOTS

$\sqrt{169} = 13$

$\sqrt{1.69} = 1.3$

2 decimal places

1 decimal place

INVERSES

$If \ 6^2 = 36 \ then \ \sqrt{36} = 6$

$If \ \sqrt{36} = 6 \ then \ 6^2 = 36$

Square roots

$$\sqrt{1000000} = 1000$$

$$\sqrt{10000} = 100$$

$$\sqrt{100} = 10$$

$$\sqrt{1} = 1$$

$$\sqrt{0.01} = 0.1$$

$$\sqrt{8100} = 90$$

$$\sqrt{6400000} = 800$$

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* $\sqrt{17}^{2} = 17$

* $\sqrt{8^2} = 8$

* NOTE: Squaring and square roots are inverse operations and cancel each other out.

Powers to KNOW

$1^2 = 1$	$7^2 = 49$
$2^2 = 4$	$8^2 = 64$
$3^2 = 9$	$9^2 = 81$
$4^2 = 16$	$10^2 = 100$
$5^2 = 25$	$11^2 = 121$
$6^2 = 36$	$12^2 = 144$

Inverse operations:

Squaring and square root

Put in ascending order:

$12^2, \sqrt{64}, \sqrt{80}, 3^2, \sqrt{7}^2, \sqrt{1}, \sqrt{52}$

____, ____, ____, ____, ____, ____, ____, ____

Square roots to KNOW

$\sqrt{1} = 1$	$\sqrt{49} = 7$
$\sqrt{4} = 2$	$\sqrt{64} = 8$
$\sqrt{9} = 3$	$\sqrt{81} = 9$
$\sqrt{16} = 4$	$\sqrt{100} = 10$
$\sqrt{25} = 5$	$\sqrt{121} = 11$
$\sqrt{36} = 6$	$\sqrt{144} = 12$

$\sqrt{121} = 11$ cm

121
cm^2

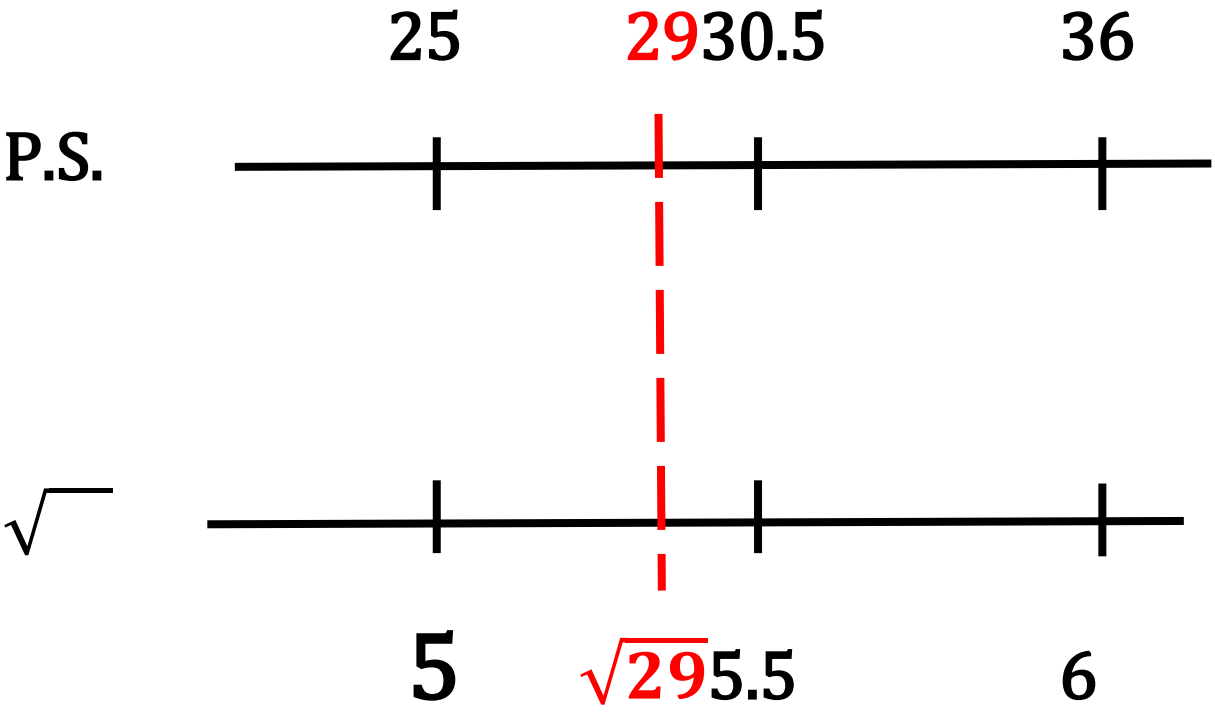
NOTE: SQUARE ROOT ($\sqrt{\ }$)

means SIDELENGTH OF A SQUARE

ESTIMATION

BENCHMARKS 0, ½, ¾ , 1, 2, etc

Estimate $\sqrt{29}$



$$\sqrt{29} \doteq 5.4$$

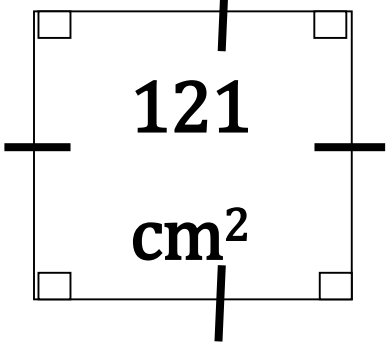
$$\sqrt{AREA} = sidelength$$

for a square

Given: AREA

Find: SIDELENGTH

$$\sqrt{121} = 11\ cm$$

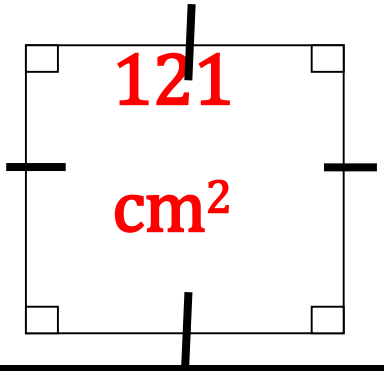


Given: SIDELENGTH

Find: AREA

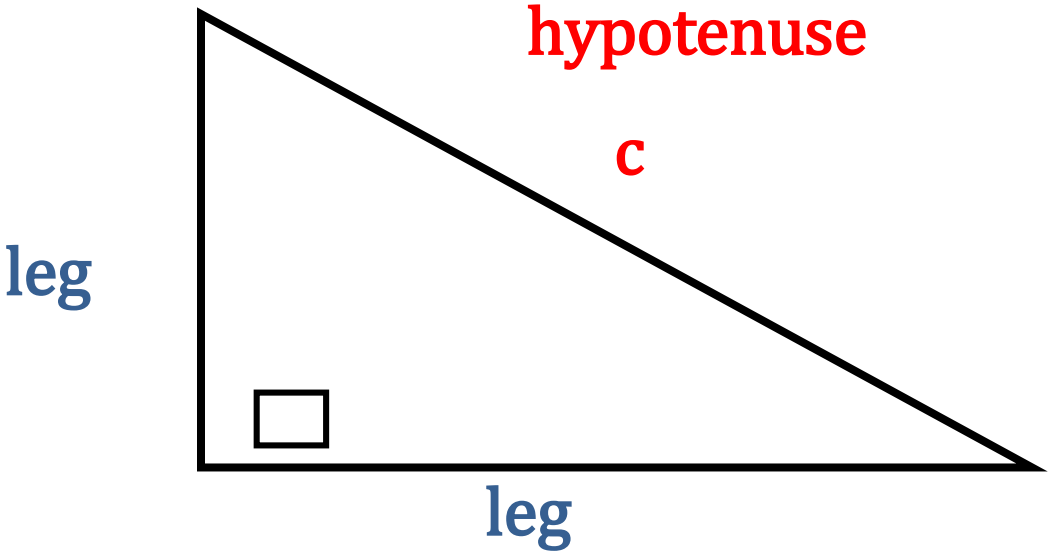
$11\ cm$ $(sidelength)^2 = AREA$

$(11)^2 = 121\ cm^2$



PYTHAGOREAN THEOREM

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



Reminder: Label your c first

Pythagorean Triples

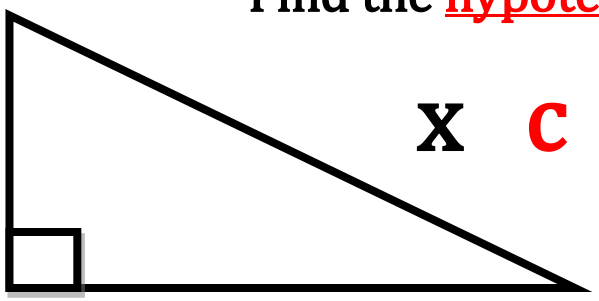
3-4-5

Multiplier x 2 6-8-10

X 10 30-40-50

Pythagorus METHOD 1

Find the hypotenuse, c.



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

$$x^2 = 5^2 + 11^2$$

$$x^2 = 25 + 121$$

$$x^2 = 146$$

$$\sqrt{x^2} = \sqrt{146}$$

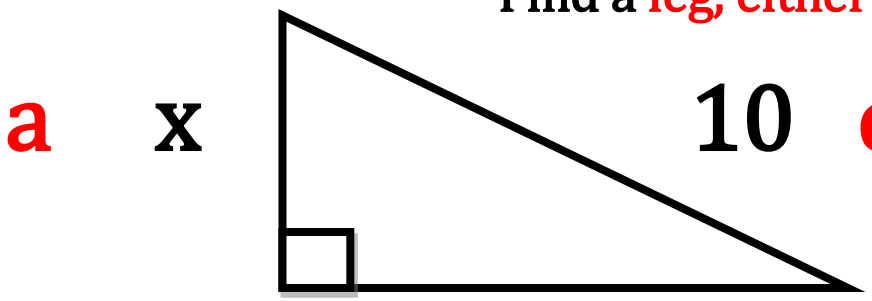
$$x = 12.08305\cdots$$

$$x \triangleq 12.1$$

rounded to nearest tenth

Pythagorus METHOD 2

Find a leg, either a or b.



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

$$10^2 = x^2 + 8^2$$

$$100 = x^2 + 64$$

$$100 - 64 = x^2$$

$$x^2 = 36$$

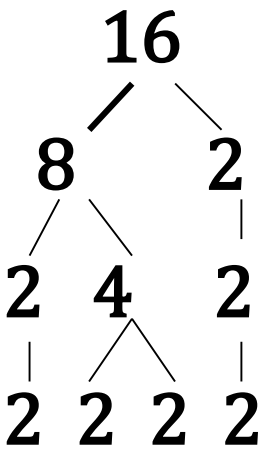
$$\sqrt{x^2} = \sqrt{36}$$

$$x = 6$$

UNITS : mm, cm, m , km ...

PRIME FACTORIZATION METHOD

IS TREE

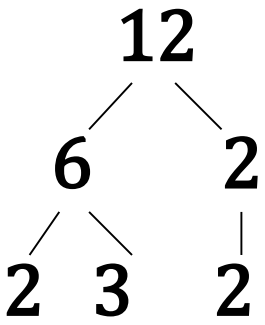


$16 = 2x2x2x2$

REASON: identical pairs of primes

CONCLUSION: So 16 IS a perfect square

IS NOT



$12 = 2x2x3$

REASON: NOT identical pairs of primes

CONCLUSION: So 12 IS NOT

a perfect square

LIST of FACTORS METHOD

IS BOWL

16 LIST

1 x 16 $16 = \{1, 2, 4, 8, 16\}$

2 x 8 REASON: ODD NUMBER of FACTORS

4 x 4 CONCLUSION: SO 16 IS a perfect square

IS NOT

12 LIST

1 x 12 $12 = \{1, 2, 3, 4, 6, 12\}$

2 x 6 REASON: NOT ODD NUMBER of FACTORS

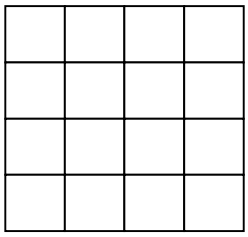
3 x 4 CONCLUSION: SO 12 IS NOT a perfect square

MODEL USING SQUARE TILES

SQUARES VS RECTANGLES

IS 16

REASON: square

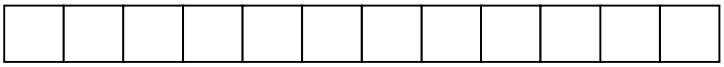


CONCLUSION: So 16 IS a perfect square

IS NOT 12

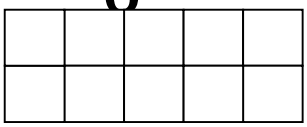
12

1



6

2

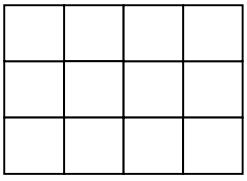


REASON:

RECTANGLES NOT square

4

3



CONCLUSION:

So 12 is NOT a perfect square

Unit 2: Integers

MULT and DIVISION only

SAME signs

$(+)(+)=(+)$ $\qquad \frac{(+)}{(+)} = (+)$

$(-)(-)=(+)$ $\qquad \frac{(-)}{(-)} = (+)$

DIFFERENCE signs

$(+)(-)=(-)$ $\qquad \frac{(+)}{(-)} = (-)$

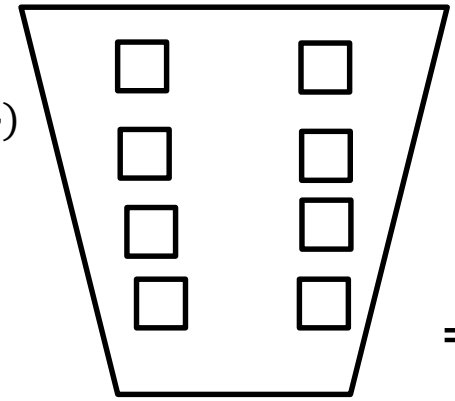
$(-)(+)=(-)$ $\qquad \frac{(-)}{(+)} = (-)$

BANKING MODEL

+VE ■ -VE □

put in

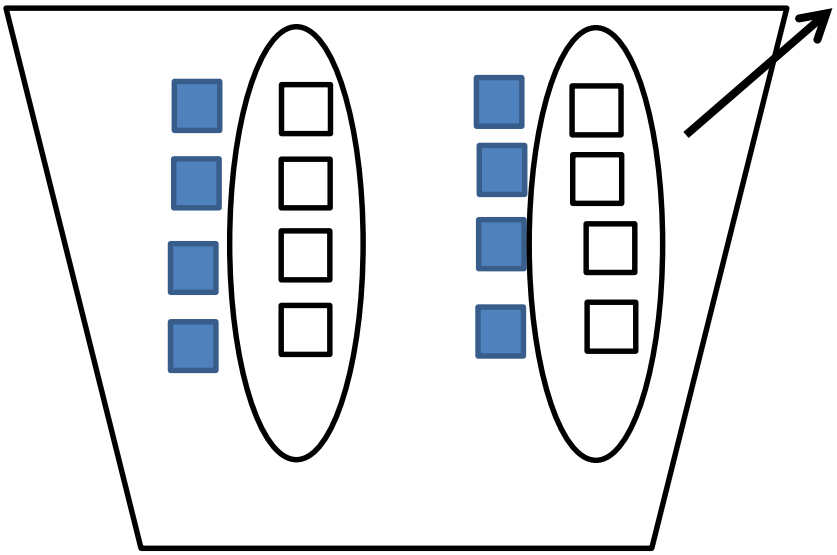
EX. 1. $(+2)(-4)$



= (-8)

remove

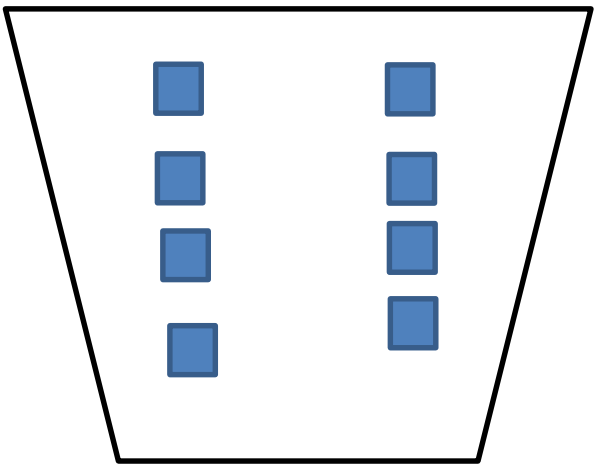
EX. 2. $(-2)(-4)$



ZERO PAIRS

STEP 1: REMOVE

STEP 2: ANSWER

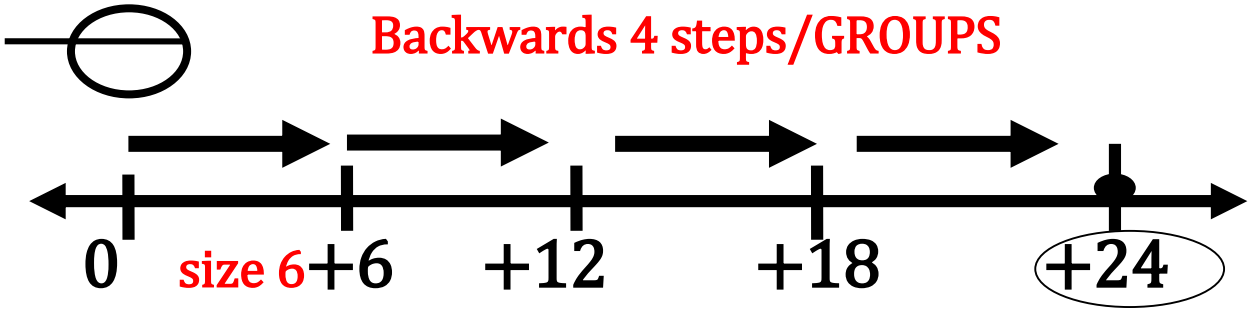


= (+8)

Mult on numberline

(facing GROUPS)(f/b SIZE) = product

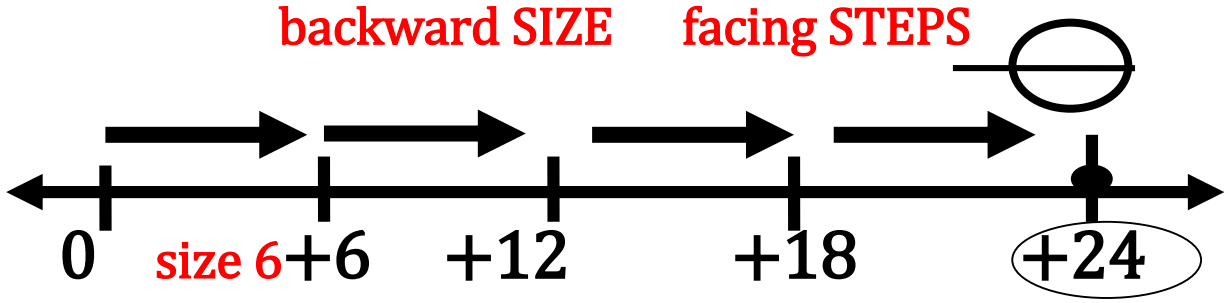
(-4)(-6) = (+24)



Division on numberline

$$dividend \div \left(\frac{f}{b} SIZE\right) = facing\ STEP$$

$$(+24) \div (-6) = (-4)$$



Properties

ZERO PROPERTY

$$8 \times 0 = 0 \qquad 0 \times (-8) = 0$$

MULTIPLICATIVE IDENTITY

$$8 \times 1 = 8 \qquad 1 \times (-8) = (-8)$$

COMMUTATIVE PROPERTY

ORDER

$$6 \times (-7) = (-7) \times 6$$

$$6+7 = 7+6$$

Properties

ASSOCIATIVE PROPERTY

GROUPING

$$(2+3)+4 = 2+(3+4)$$

$$(2 \times 3)\times 4 = 2 \times (3 \times 4)$$

DISTRIBUTIVE PROPERTY

$$2(3+4) = 2\times 3+2\times 4$$

Multiplier

$$2(3-4) = 2 \times 3 - 2 \times 4$$

Multiplier

AREA MODEL

GROUP of a SIZE

$(-23)(+47)$ of SIZE

GROUP	+40	+7
-20	(-20)(+40) = -800	(-20)(+7) = -140
-3	(-3)(+40) = -120	(-3)(+7) = -21

$$(-23)(+47)$$

$$= (-800) + (-140) + (-120) + (-21)$$

$$= \boxed{(-1081)}$$

Word problem

Ex. 1. The product of two numbers is +48.

The sum of the same two numbers is -14. What are the numbers?

SUM $(-6) + (-8) = (-14)$

PRODUCT $(-6)(-8) = (+48)$

48	+ve
1 x 48	(+)(+)
2 x 24	(-)(-)
4 x 12	
6 x 8	

Ex. 2 The product of two numbers is +20.

The sum of the same two numbers is +2. What are the numbers?

SUM $(-4) + (+5) = (+2)$

PRODUCT $(-4)(+5) = (-20)$

20	-ve
1x 20	(-)(+)
2 x 10	(+)(-)
4x5	

BEDMAS

REMEMBER: change ONE thing per line (underlined)

L → R L → R

SUBTRACTION means ADD the OPPOSITE

Ex. 1

$$-2 + 5 \times (-6)$$
$$= -2 + (-30)$$
$$= \boxed{-32}$$

Ex. 2

$$5 - (-50) \div (+10)$$
$$= 5 - (-5)$$
$$= +5 + (+5)$$
$$= \boxed{+10}$$

Ex. 3

$$(-2) + (-4)(-6) - 3$$
$$= (-2) + (+24) - (+3)$$
$$= +22 - (+3)$$
$$= +22 + (-3)$$
$$= \boxed{+19}$$

Ex 4

$$\frac{-12+2(-1)}{(-9)-2}$$
$$= \frac{-12+(-2)}{(-9)+(+2)}$$
$$= \frac{-14}{-7}$$
$$= \boxed{+2}$$

Ex. 5

$$(-9) \times 0 = 0$$
$$\frac{0}{-9} = \boxed{0}$$
$$\frac{-9}{0} = \boxed{\text{undefined}}$$

NOTE: CANNOT divide by ZERO

Ex.

$$(-6)^2$$
$$= (-6)(-6)$$
$$= \boxed{+36}$$

$$-6^2$$
$$= -1 \cdot 6^2$$
$$= -1 \cdot (+36)$$
$$= \boxed{-36}$$

WORD PROBLEMS involving INTEGERS

Ex. 1.
A submarine dives 9 m for 10 hours. What is the change in distance?

GROUPS of a SIZE

(+10) (-9)

= (- 90) meters

Ex. 2
The temperature drops 5 °C every 3 hours. It this happens for 12 hours what is the change in temperature?

Groups $\frac{12}{3}$ = 4 groups

Groups of SIZE

(+4) (-5)

= (- 20) ° C

Ex. 3
Alice deposited $10 per week. She had a total of $120 in the bank. How many weeks did this take?

$\frac{+120}{+10}$ = **12 *weeks***

Ex. 4 Distributive Property

Expand $2[(-3) + (-5)]$ then solve.
(x: multiplier)

= 2 x (-3) + 2 x (-5) expand

= (-6) + (-10)
= (-16)

Ex. 5
The product of two integers is 24
The sum of the same two integers is -10.
What are the integers?

SUM (-3) + (-8) = (-11)

PRODUCT (-3)(-8)= (+24)

24	+ve
1 x 24	+ +
2 x 12	- -
3 x 8	
4 x 6	

Ex. 6
Fred travels at 80 km per hour for 10 hours. He is still 100 km from his destination. Using one equation with two operation, create and solve to find how far he had to travel?

Travel = groups x size + tagalong
(tagalong: Remainder of journey)

= (+10)(+80) + 100

= (+800) + 100

= +900 km

Unit 3: FRACTIONS

$$\frac{numerator}{denominator}$$

ADDING

Get CD

$$\frac{ADD\ numerators}{CD}$$

MULTIPLYING

$$\frac{n \times n}{d \times d}$$

OR

Cancellation Method

SUBTRACTING

Get CD

$$\frac{SUBTRACT\ numerators}{CD}$$

OR

$$\frac{add\ opposite\ numerators}{CD}$$

DIVIDING

Mult. by reciprocal

$$\frac{1}{2} \div \frac{3}{4} = \frac{1}{2} \times \frac{4}{3}$$

OR CD Method

$$\frac{1}{2} \div \frac{3}{4} \qquad CD = 4$$

$$= \frac{2}{4} \div \frac{3}{4}$$

$$= \frac{2}{3}$$

REMEMBER: Reduce final fractions

FRACTIONS

ADDITION

$$\text{CD} = \frac{ADD\ numerators}{CD}$$

SUBTRACTION

$$\text{CD} = \frac{SUBTRACT\ numerators}{CD}$$

NOTE: Remember to simplify *all final answers*

FRACTION

MULTIPLICATION

$$\frac{n}{d} \times \frac{n}{d} = \frac{n \times n}{d \times d}$$

OR Cancellation Method (CD Method)

DIVISION

Mult by reciprocal	CD Method
$\frac{2}{3} \div \frac{4}{5}$ $= \frac{2}{3} \times \frac{5}{4}$ $= \frac{10}{12}$ $= \frac{5}{6}$	$\frac{2}{3} \div \frac{4}{5}$ CD = 15 $= \frac{10}{15} \div \frac{12}{15}$ $= \frac{10}{12}$ $= \frac{5}{6}$

AREA MODEL

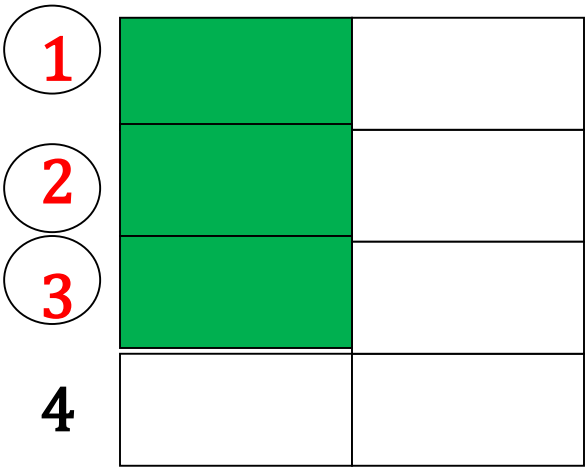
$$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$$

$\frac{1}{2}$ of

x (1) 2

3

4



//8

$$\frac{shaded}{total}$$

$$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$$

AREA MODEL mixed fractions

$$1\frac{2}{3} \times 4\frac{4}{5}$$

x	1	$\frac{2}{3}$
4	4 x 1 = 4	$4 \times \frac{2}{3} = \frac{8}{3}$
$\frac{4}{5}$	$\frac{4}{5} \times 1 = \frac{4}{5}$	$\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$

$1\frac{2}{3} \times 4\frac{4}{5} = 4 + \frac{8}{3} + \frac{4}{5} + \frac{8}{15}$ CD = 15

$= 4 + \frac{40}{15} + \frac{12}{15} + \frac{8}{15}$

$= 4 + \frac{60}{15}$

$= \boxed{8}$

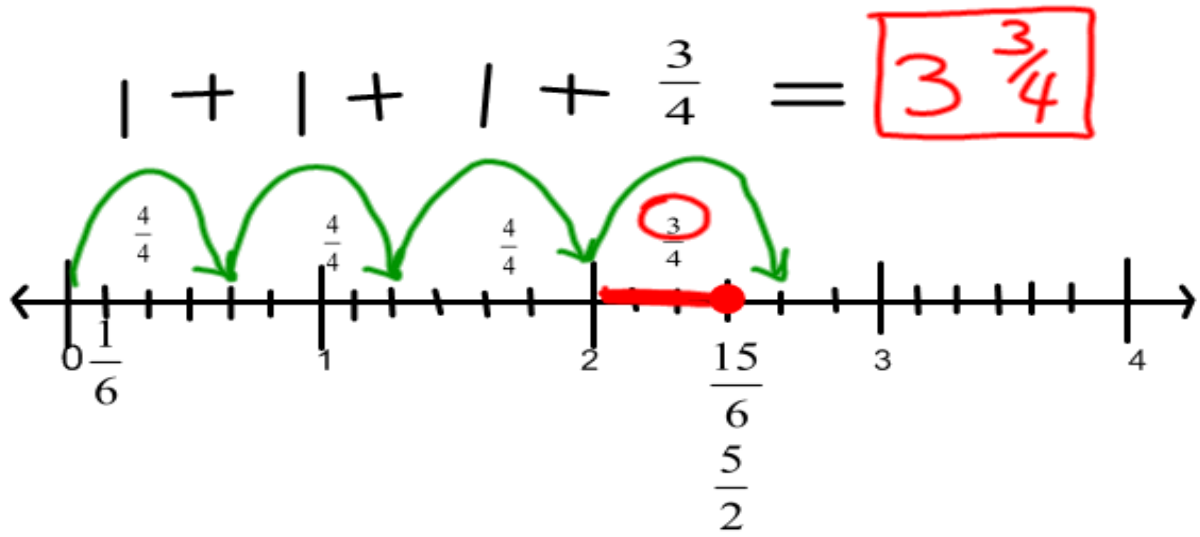
DIVISION on a NUMBERLINE

- Change fractions to CD
- Ist fraction
  - what you have
- 2nd fraction
  - jump SIZE (numerator)
- Divide line into parts
  - use CD
- Go past what you have when you complete jump SIZE
- Count full jumps
- Count Part jump
  - parts out of
    total parts of that ONE jump
    (____/circled number)

Division on a numberline

$\frac{5}{2} \div \frac{2}{3}$ CD = 6

$= \frac{15}{6} \div \frac{4}{6}$ ← **pieces** in 1 jump

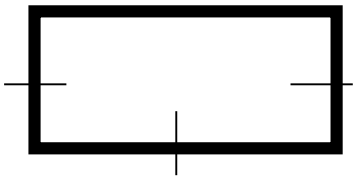


3 full jumps and ¾ of another jump

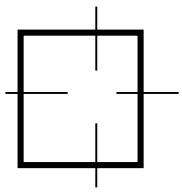
Answer is $3\ \frac{3}{4}$

Unit 4: 3D AREA

units: mm^2, cm^2, m^2, km^2



$$A = l \times w$$

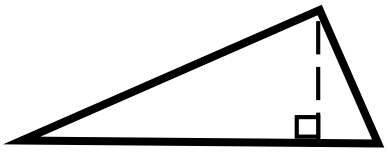


$$A = s^2$$

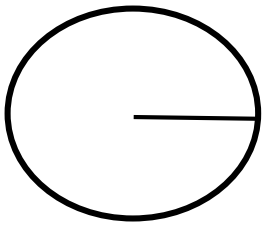
square

$$A = bh$$

parallelogram



$$A = \frac{bh}{2}$$

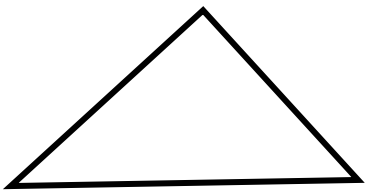


$$A = \pi r^2$$

Distance AROUND objects

PERIMETER

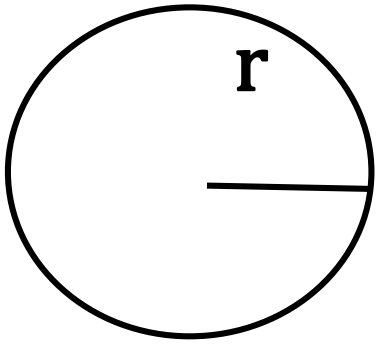
$$P = 2l + 2w$$



$$P = s_1 + s_2 + s_3$$

CIRCUMFERENCE

$$d = 2r \qquad r = \frac{d}{2}$$

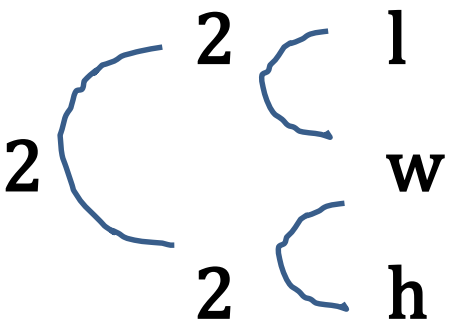


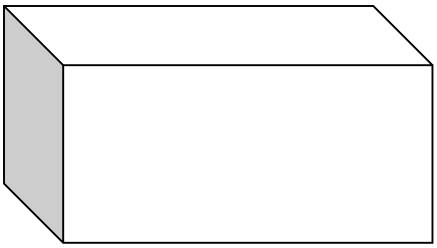
$$C = 2\pi r$$

$$C = \pi d$$

SURFACE AREA unit ^{2}

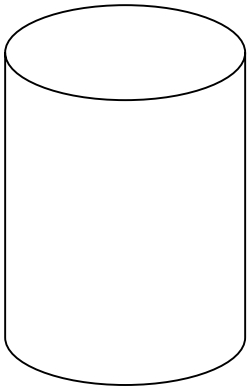
$$S.A. = 2lw + 2wh + 2lh$$

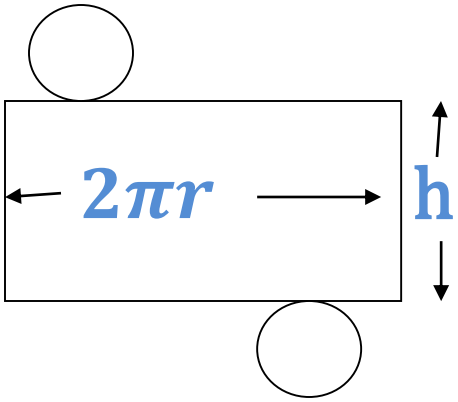




$$S.A. = 2\pi r^2 + 2\pi rh$$

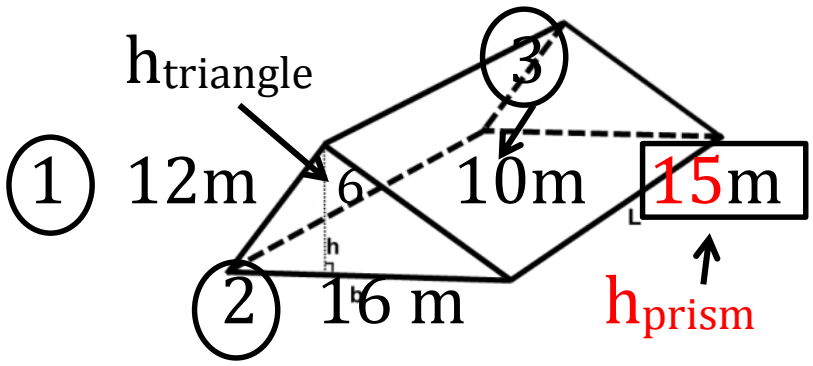
2 circles curved surface





Surface Area of triangular prism

unit^2



Area of rectangles

A = h_{prism} x sidelength of triangle

$A_{1\ triangle} = \frac{bh}{2}$

$= \frac{(16)(6)}{2}$

$= 48$

$A_{2\ triangles} = 2 \times 48$

$= 96$

1 15×12

$= 180$

2 15×16

$= 240$

3 15×10

$= 150$

S.A. $= 96 + 180 + 240 + 150$

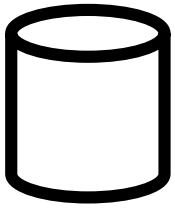
$= 666\ m^2$

VOLUME = BASE x HEIGHT

(units mm^3, cm^3, mL)

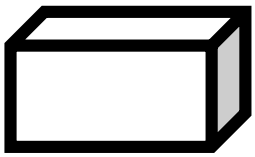
Remember: $1\ cm^3 = 1\ mL$

CYLINDER



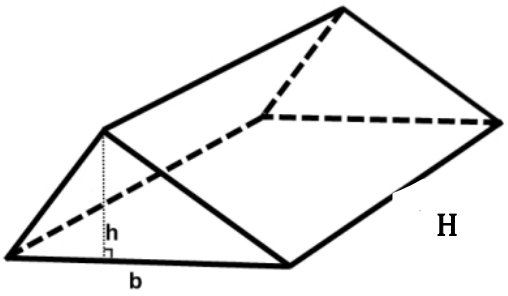
$$V = \pi r^2 h$$

RECTANGULAR PRISM



$$V = lwh$$

TRIANGULAR PRISM



$$V = \frac{lwh}{2}$$

Unit 5:percents, decimals, rates, Ratios

Conversions

PERCENT	decimal	fraction	Ratio part: total
70%	0.70 =0.7	$\frac{70}{100} = \frac{7}{10}$	70:100 = 7:10
123% >100%	1.23	$\frac{123}{100}$	123:100
0.7% <1%	0.007	$\frac{0.7}{100} = \frac{7}{1000}$	0.7:100 =7:1000 NO DECIMALS
$\frac{4}{5}$ % = 0.8% <1%	0.008	$\frac{0.8}{100} = \frac{8}{1000} = \frac{1}{125}$	0.8:100 =8:1000 = 1:125 Reduce all ratio/rates

$0.\overline{7} = 0.777\cdots$

$0.125 = \frac{1}{8}$

Setting up RATES

Words first $\frac{kg}{\$}$ $\frac{3}{6.57} = \frac{5}{x}$

Cross multiply $3x = 5(6.57)$

(Do the variable part first) $3x = 32.85$

Divide BOTH sides by 3 $\frac{3x}{3} = \frac{32.85}{3}$

$$\boxed{x = \$10.95}$$

Ex. Sale price is $646 for a 15% of regular price sale. What is original price? 100%-15% = 85% or $\frac{85}{100}$

SO DP is 85% of original price.

$\frac{part}{total}$ $\frac{646}{x} = \frac{85}{100}$ CROSS MULTIPLY then solve

$\frac{85x}{85} = \frac{64600}{85}$

$x = \boxed{\$760}$

PERCENT CHANGE

$$\%\ CHANGE = \frac{NEW - OLD}{OLD} \times 100$$

$$= \_\_\_\_\_\%$$

INCREASE **+VE**

Growth or rise in something

DECREASE **-VE**

Shrinking or drop in something

UNIT 6: LINEAR EQUATIONS and GRAPHING

SOLVING Linear Equations

1. $-3x - 4 = 11$

$-3x - 4 \underline{+4} = 11 \underline{+4}$

$\frac{-3x}{-3} = \frac{15}{-3}$

$x = -5$

2. $7 + \frac{d}{4} = 13$

$7 + \frac{d}{4} - 7 = 13 - 7$

$\frac{d}{4} \times \frac{6}{1}$ cross multiply

$d = 24$

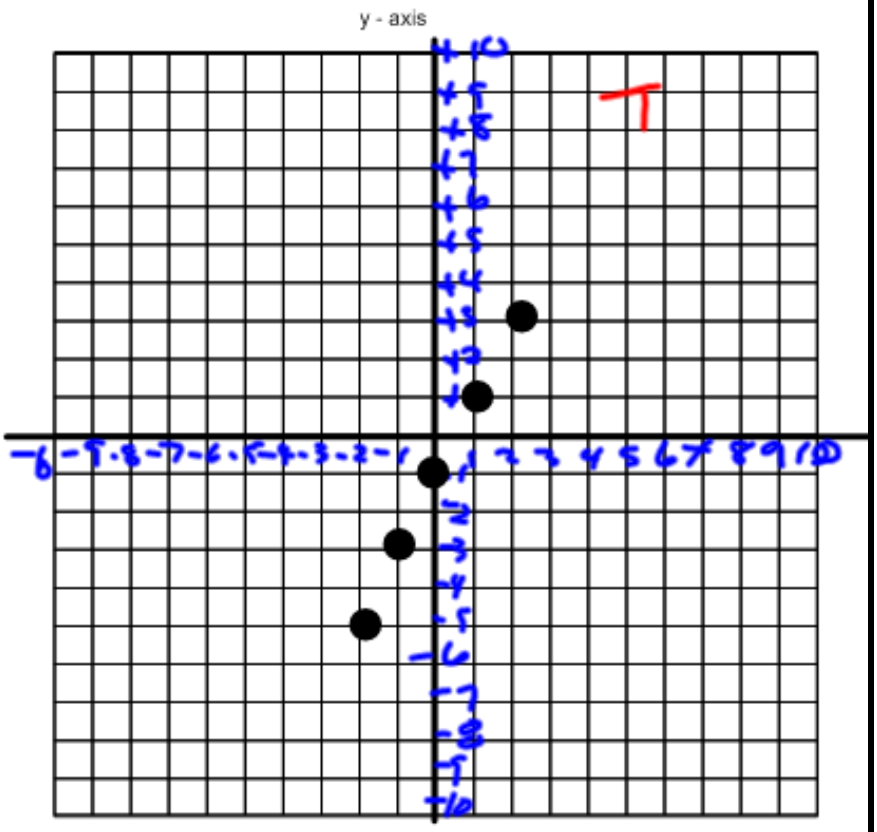
3. $-5(3x - 4) = -15x + 20$

4. $-2(-4x + 5) = 8x - 10$

Graphing linear equations

$y=2x-1$

x	y
-2	-5
-1	-3
0	-1
1	1
2	3



Is this a linear graph? yes or no

Why: first level of differences for x and y are constant

Describe this graph: straight line

Describe this graph in terms of x and y:

As x increases (decrease/increase) by 1, y increases (decrease/increase) by 2

UNIT 7 : GRAPHS and Misinterpretations

Bar graph : bars

width of bars must be the same

height of bars will vary

specific qualities of objects – larger values

Circle Graph: percentages of objects given

Double Bar Graph: two sets of data on same bar graph

Line graph: changes over time

Pictograph : images represent numbers of objects

low numbers of objects

MISINTERPRETATIONS:

- On your graph, axis scale does not start at ZERO
- Scale of axis too small
- Sector of circle graph pulled away from the others
- Bar width vary in bar graph/double bar graph
- Size of items not the same in pictograph

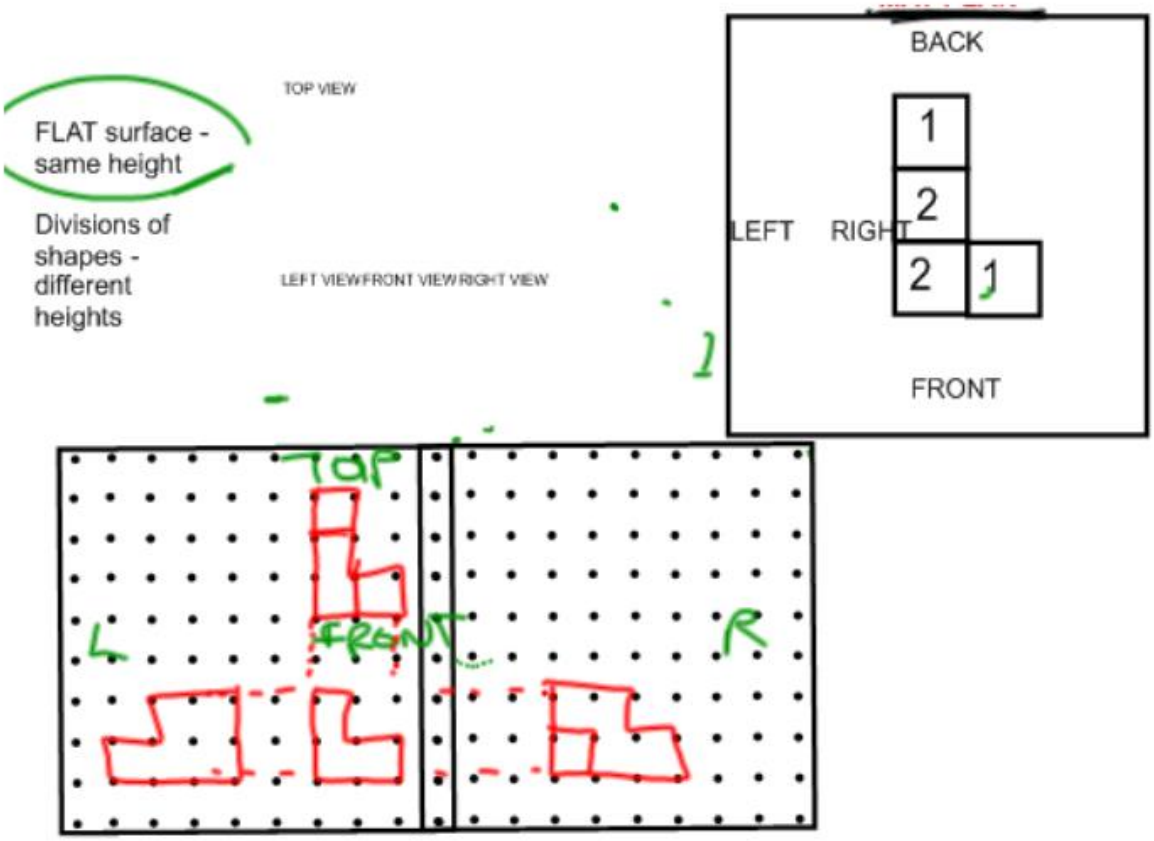
$$P(A) = \frac{possible\ outcomes\ of\ Event\ A}{TOTAL\ number\ of\ possibilities}$$

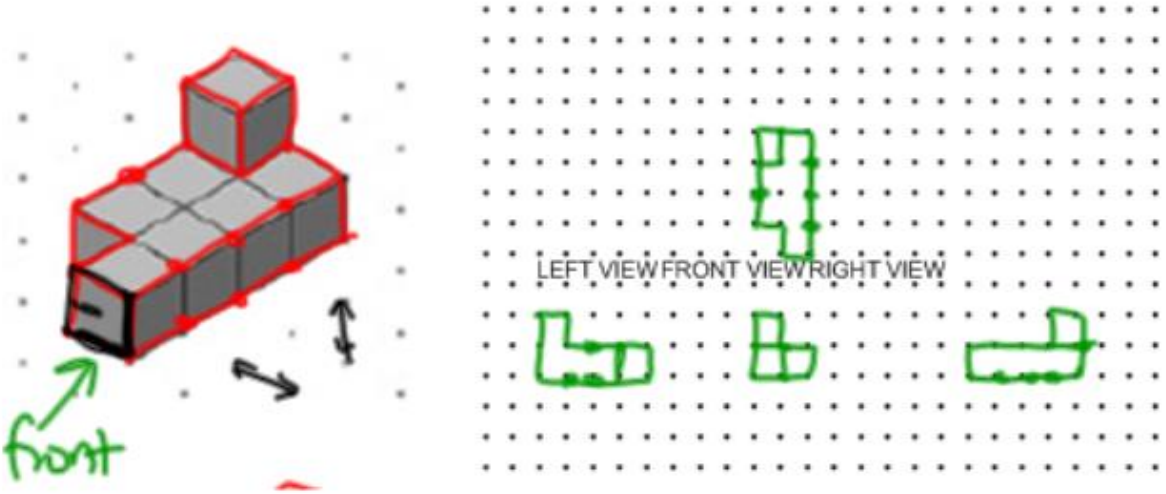
$$P(A \text{ and } B) = P(A) \times P(B)$$

$$P(A \text{ or } B) = P(A) + P(B)$$

$$P(\text{not } A) = 1 - P(A)$$

UNIT 8 TESSELLATIONS





Rotation — Vertical axis of rotation

object can be rotated

clockwise (c)

counterclockwise (cc)

Same

90 c = 270 cc (Same position)

180 c = 180 cc

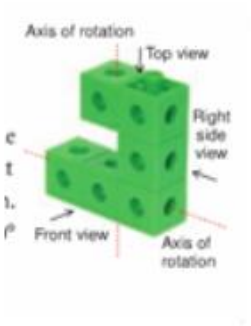
270 c = 90 cc

360 c or 360 cc = doesn't change

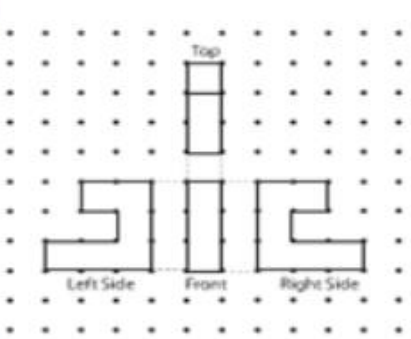
Horizontal axis of rotation

c → towards you

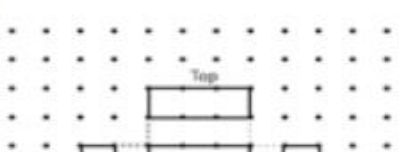
cc → away from you.



3. a)



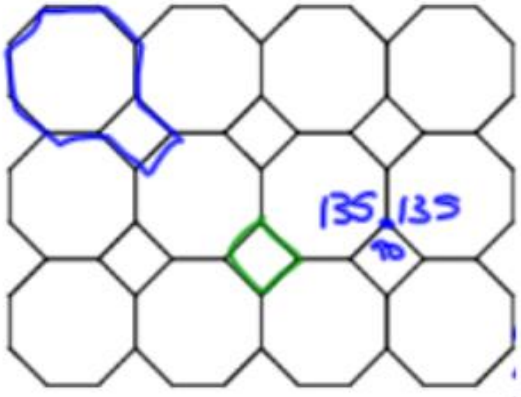
b)



Regular tessellation

- tessellation made up of regular polygons * No overlap between shapes
- sum of the angles where vertices meet * No gaps between shapes

at ONE POINT is 360°



Interior angles table

REGULAR POLYGON	INTERIOR ANGLE MEASURE
triangle	60°
square	90°
pentagon	108°
hexagon	120°
octagon	135°
decagon	144°
dodecagon	150°

3
4
5
6
8
10
12

Tessellation not regular