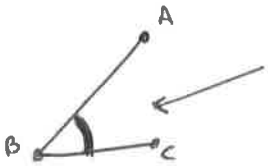
# GEOMETRY (SPACE / SHAPES / ANGLES / LINES)

## ANGLES

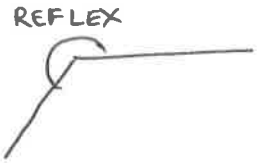



THIS CAN BE WRITTEN AS $\angle ABC$ OR $\angle B$

## TYPES OF ANGLE :

ACUTE

OBTUSE



REFLEX

RIGHT - ANGLE = $90^\circ$ = PERPENDICULAR

STRAIGHT LINE = $180^\circ$

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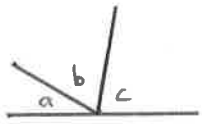
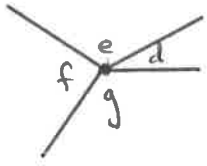



ALL ANGLES WHICH MAKE UP A STRAIGHT LINE ADD UP TO $180^\circ$

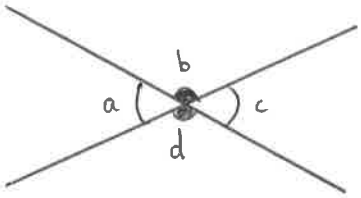
$a + b + c = 180^\circ$




ALL ANGLES AT A POINT WHICH MAKE UP A FULL CIRCLE ADD UP TO $360^\circ$

$d + e + f + g = 360^\circ$

# QUESTIONS WITH ANGLES



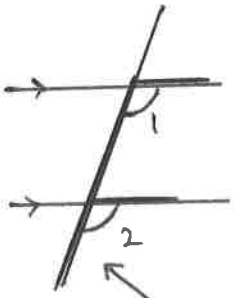

$a = c$

$b = d$

VERTICALLY OPPOSITE

LOOK FOR X

IF TWO LINES ARE PARALLEL:

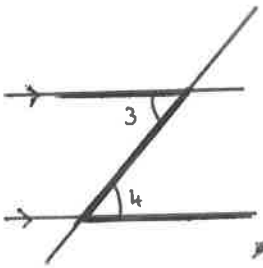



THESE ANGLES ARE CORRESPONDING

$|\angle 1| = |\angle 2|$

LOOK FOR F SHAPE

THIS LINE (CROSSING PARALLEL LINES) IS CALLED A "TRANSVERSAL"



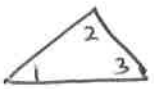

THESE ANGLES ARE ALTERNATE

$|\angle 3| = |\angle 4|$

LOOK FOR Z SHAPE

# TRIANGLES

ALL 3 ANGLES ADD UP TO 180°



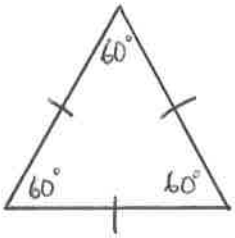

$\angle 1 + \angle 2 + \angle 3 = 180°$

## TYPES OF TRIANGLE

### EQUILATERAL

ALL 3 SIDES ARE THE SAME

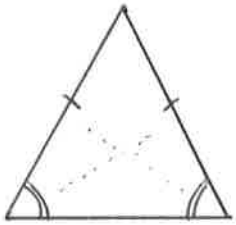
ALL 3 ANGLES ARE THE SAME (60°)




### ISOSCELES

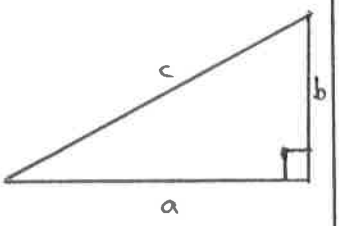
2 EQUAL SIDES

2 EQUAL ANGLES.



DON'T MIX THESE UP

### RIGHT - ANGLED




1 ANGLE OF 90°

OTHER 2 ANGLES HAVE TO ADD UP TO 90°

PYTHAGORAS $a^2 + b^2 = c^2$ (c: HYPOTENUSE)

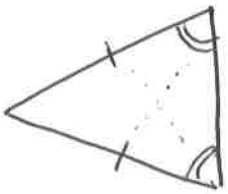
A TRIANGLE WHICH IS NOT ANY OF THE OTHER 3 TRIANGLES IS CALLED A

**SCALENE TRIANGLE**

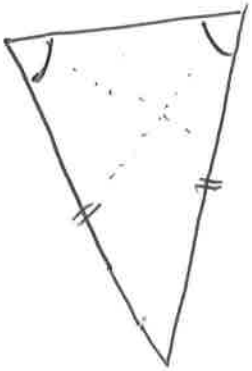
**REMEMBER** AN ISOSCELES TRIANGLE CAN BE DRAWN FACING ANY DIRECTION ... THEY MIGHT BE TRYING TO TRICK YOU.

IT IS THE TWO ANGLES WHICH ARE OPPOSITE THE TWO EQUAL SIDES WHICH ARE EQUAL

eg



OR



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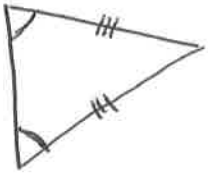

IN ANY TRIANGLE :

* THE LARGEST ANGLE IS OPPOSITE THE LONGEST SIDE

AND

* THE SMALLEST ANGLE IS OPPOSITE THE SMALLEST SIDE.

THIS MAKES SENSE LOGICALLY IF YOU JUST THINK ABOUT IT FOR A MINUTE...

ALSO

THE LENGTH OF THE SMALLEST 2 SIDES ADDED TOGETHER HAVE TO BE LONGER THAN THE LONGEST SIDE. OTHERWISE YOU CAN'T MAKE A TRIANGLE OUT OF THEM.

REMEMBER... WE TRIED!

THEY DON'T REACH !!

* OFTEN, IF THEY ASK YOU A STRANGE QUESTION ABOUT WHETHER A TRIANGLE CAN EXIST, THEY WANT YOU TO USE THIS THEOREM.

# PARALLELOGRAMS

HAS:
- FOUR SIDES
  - OPPOSITE SIDES ARE EQUAL LENGTH + PARALLEL.
  - OPPOSITE ANGLES ARE EQUAL

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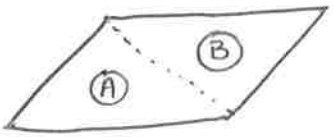
DIAGONALS ACROSS PARALLELOGRAMS ARE VERY INTERESTING

- DIAGONALS "BISECT" THE AREA

BISECT MEANS "CUT IN HALF"

eg

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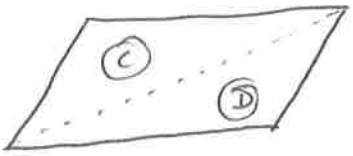
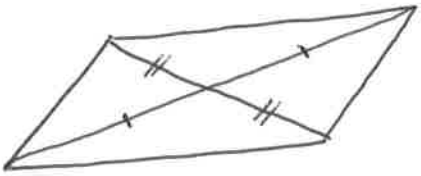



AREA (A) = AREA (B)

AREA (C) = AREA (D)

- DIAGONALS ALSO BISECT EACH OTHER

eg



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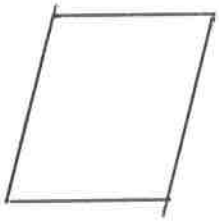
DON'T GET CONFUSED BY "TALL" PARALLELOGRAMS!

THEY WORK THE SAME WAY!

eg



# CONGRUENT TRIANGLES

**CONGRUENT = IDENTICAL**

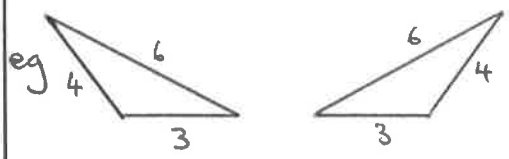
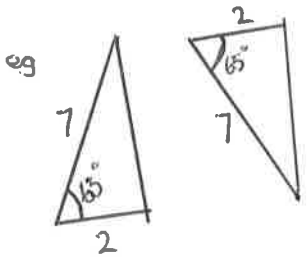
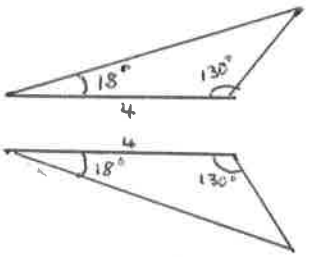
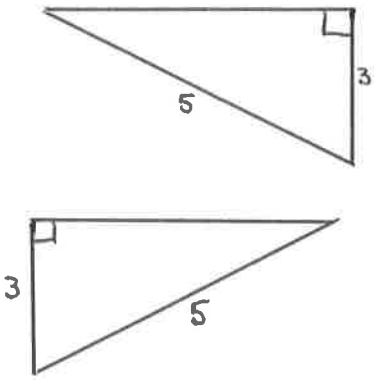
TRIANGLES ARE CONGRUENT IF :

4 WAYS
- S.S.S.
- S.A.S
- A.S.A.
- R.H.S

**NOT A.A.A.** ← DON'T MAKE THIS MISTAKE!

THIS IS SIMILAR

WHY ARE THEY CONGRUENT?

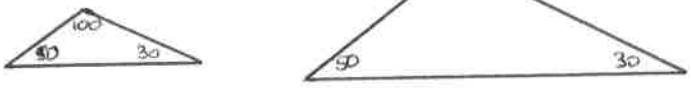
| | | |
|---|---|---|
| S.S.S. | IF ALL THREE SIDES ARE THE SAME LENGTH | eg   |
| S.A.S. | IF 2 SIDES AND THE ANGLE IN-BETWEEN ← NOT JUST ANY ANGLE | eg   |
| A.S.A. | 2 ANGLES AND THE SIDE IN-BETWEEN | eg   |
| R.H.S. | IF BOTH TRIANGLES HAVE A RIGHT-ANGLE, THE SAME HYPOTENUSE LENGTH AND ONE OTHER SAME SIDE | eg   |

# SIMILAR TRIANGLES (NOT THE SAME AS CONGRUENT)

[SAME ANGLES]

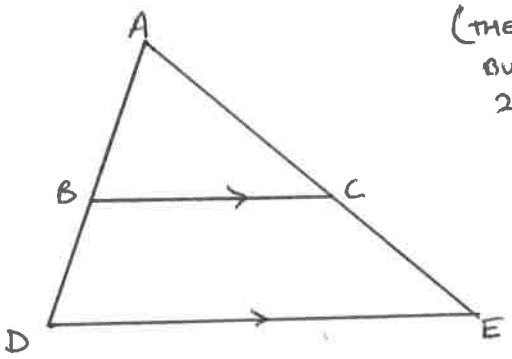
SIMILAR TRIANGLES ARE LIKE A LARGER / SMALLER VERSION OF EACH OTHER.

eg




THESE CAN BE DRAWN ONE INSIDE THE OTHER :

(THESE ARE OFTEN TREATED DIFFERENTLY, BUT ACTUALLY THEY ARE JUST 2 SIMILAR TRIANGLES)

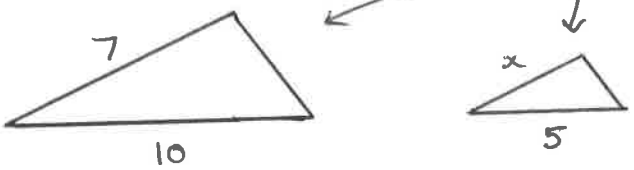



△ ABC AND △ ADE HAVE THE SAME ANGLES, SO ARE SIMILAR TRIANGLES.

**THEOREM** THE CORRESPONDING SIDES OF SIMILAR TRIANGLES ARE IN THE SAME RATIO *

WE USE THIS TO WORK OUT LENGTHS OF SIDES.

SIMILAR TRIANGLES




* "FRACTIONS" AND "RATIOS" ARE ESSENTIALLY THE SAME

WRITE DOWN AN EQUATION WITH

"UNKNOWN" FRACTION = KNOWN FRACTION

eg $\frac{x}{5} = \frac{7}{10}$

THESE SIDES MUST BE THE ONES THAT CORRESPOND TO THE "UNKNOWN" SIDES

THEN SOLVE

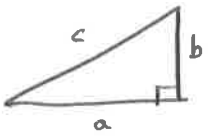
$10x = 35$

$x = 3.5$

## PYTHAGORAS

IF YOU SEE A RIGHT-ANGLED TRIANGLE, THINK **PYTHAGORAS**

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

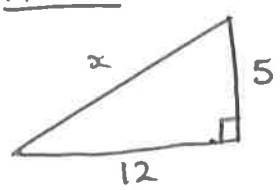



BE CAREFUL.

THE HYPOTENUSE$^2$ IS ALWAYS ON ITS OWN ON ONE SIDE OF THE EQUATION

FIND $x$

eg




$5^2 + 12^2 = x^2$

$25 + 144 = x^2$

$169 = x^2$

$x = 13$

① MAKE AN EQUATION

② SOLVE IT!

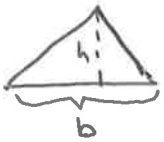
IMPORTANT: IF $x^2 = 169$, $x = \sqrt{169}$

REMEMBER, THEY MIGHT TRY TO CONFUSE YOU BY GIVING YOU THE TRIANGLE "UPSIDE-DOWN" OR FACING A DIFFERENT DIRECTION.

DON'T LOSE THE GAME OF "FIND THE RIGHT-ANGLED TRIANGLE"!!

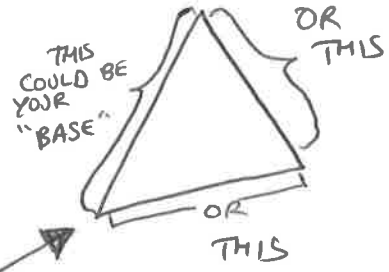
## AREA OF TRIANGLE / PARALLELOGRAM.

ANY TRIANGLE



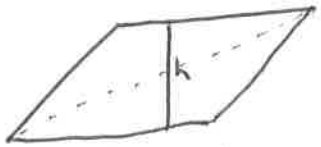

AREA $= \frac{1}{2}bh$ ← THIS IS HOW IT IS WRITTEN IN THE TABLES BOOK

($\frac{1}{2}$ × BASE × PERPENDICULAR HEIGHT)




N.B. THE CHOICE OF BASE DOESN'T MATTER

PARALLELOGRAM



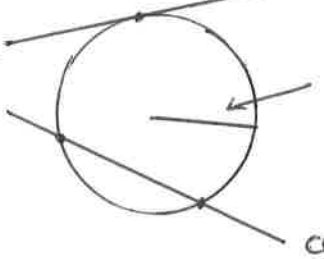

AREA $= bh$

[BASE × HEIGHT]

← THIS BECAUSE ~~THE~~ DIAGONAL DIVIDES A PARALLELOGRAM IN HALF.

SO A PARALLELOGRAM IS BASICALLY 2 TRIANGLES JOINED TOGETHER

# CIRCLES



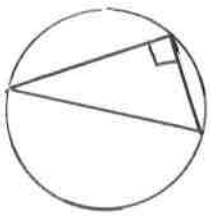
TANGENT (TOUCHES CIRCLE AT ONE POINT)

RADIUS (LENGTH FROM CENTRE TO ANY POINT OF THE CIRCLE)

DIAMETER (TWICE LENGTH OF RADIUS)

CHORD (LINE THAT CUTS/TOUCHES CIRCLE AT TWO POINTS)

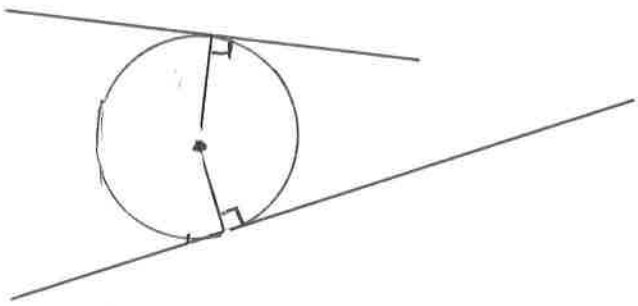
← LEARN THESE WORDS



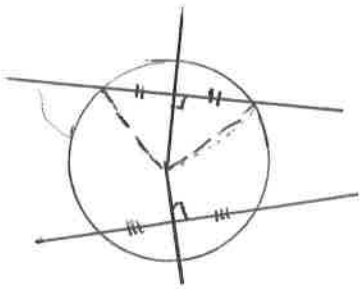
← THE ANGLE IN A SEMI-CIRCLE IS A RIGHT ANGLE

TANGENTS / CHORDS [+ PERPENDICULAR LINES ↖ 90°]

EACH TANGENT IS PERPENDICULAR TO THE RADIUS AT THAT POINT.



TH CAN BE USEFUL TO FIND THE CENTRE OF A CIRCLE OR TO RECOGNISE A RIGHT ANGLE / RADIUS IN A PICTURE...



← THE DOTTED LINES ARE OFTEN VERY USEFUL, BECAUSE NOW WE HAVE 2 RIGHT-ANGLED TRIANGLES,

↙ WHICH ARE 2 RADII (RADIUSES)

# QUESTIONS WITH CIRCLES AND TRIANGLES

LOOK FOR :

## SEMI - CIRCLES

- BECAUSE THE ANGLE IN A SEMI CIRCLE IS 90° (RIGHT ANGLE)

## RADII (OR RADIUSES)

- BECAUSE IT WILL HELP US FIND ISOSCELES TRIANGLES.

## ISOSCELES TRIANGLES

- BECAUSE ANGLES AT THE BASE ARE THE SAME.

## RIGHT - ANGLED TRIANGLE

- BECAUSE THEN I CAN WORK OUT THE SIDE - LENGTHS USING PYTHAGORAS $a^2 + b^2 = c^2$

## DIAMETER (TWICE THE RADIUS)

- BECAUSE I CAN USE THIS TO FIND OUT LENGTHS OF OTHER SIDES.

(1) TRY TO FIGURE OUT WHAT ARE THEY NOT TELLING ME ??

(2) IF YOU CAN'T IMMEDIATELY WORK OUT WHAT YOU ARE LOOKING FOR, WORK SOMETHING ELSE OUT IT MIGHT HELP ...