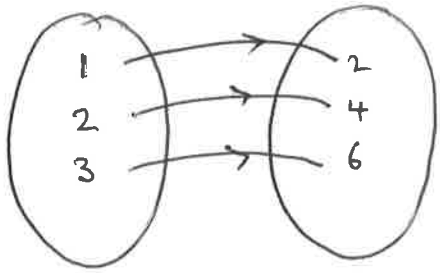
FUNCTIONS

[INPUTS → OUTPUTS]

A **FUNCTION** IS LIKE A "RULE", OR A "MACHINE". FOR **EVERY INPUT**, A FUNCTION GIVES US A PARTICULAR **OUTPUT**

WAYS OF SHOWING A FUNCTION:

MAPPING DIAGRAM



INPUTS OUTPUTS

DOMAIN
ALL OF THE INPUTS

RANGE
ALL OF THE OUTPUTS

TABLE

INPUT	FUNCTION (RULE)	OUTPUT
-1	ADD 3	2
0	ADD 3	3
1	ADD 3	4
2	ADD 3	5

COUPLES / PAIRS

$$\{(1,2)\ (2,4)\ (3,6)\}$$

INPUT OUTPUT
(x, y)

FUNCTION NOTATION

$$f(x) = x^2$$

$$f(1) = (1)^2 = 1$$

$$f(2) = (2)^2 = 4$$

$$f(7) = (7)^2 = 49$$

INPUT OUTPUT

IMPORTANT NOTES / TERMS

THESE MEAN SAME THING.

x = INPUT

y = OUTPUT → ALSO $\boxed{y = f(x)}$

DOMAIN = ALL THE INPUTS

RANGE = ALL THE OUTPUTS

CODOMAIN = ALL THE "POSSIBLE" OUTPUTS

TWO INPUTS COULD HAVE THE SAME OUTPUT.

eg $f(x) = x^2$

DIFFERENT INPUTS

$f(1) = (1)^2 = 1$

AND

$f(-1) = (-1)^2 = 1$

SAME OUTPUTS

BUT

ONE INPUT <u>CAN'T</u> HAVE TWO DIFFERENT OUTPUTS.

i.e. THERE IS ONLY ONE OUTPUT FOR EACH INPUT.

SUBSTITUTION :
- IF YOU'RE GIVEN THE FUNCTION eg $f(x) = 2x + 3$
- REPLACE THE x WITH EACH INPUT (IN A BRACKET)

SO $f(2) = 2(2) + 3$

$f(2) = 7$

$(2, 7)$

COMPOSITE FUNTIONS

WHERE WE HAVE TO DO ONE FUNCTION AFTER ANOTHER...

eg $f(g(x))$

OR

$f \circ g(x)$

eg $f(x) = 3x + 4$ AND $g(x) = x^2$

FIND (i) $f \circ g(2)$

(ii) $g(f(2))$

(i) $f \circ g(2)$ ← MEANS f AFTER $g(2)$

← SO DO $g(2)$ FIRST, THEN DO f TO YOUR ANSWER.

$g(2) = (2)^2$

$= 4$

$f(4) = 3(4) + 4$

$= \boxed{16}$

(ii) $g(f(2))$ ← MEANS g OF $f(2)$

← SO DO $f(2)$ FIRST, THEN DO g TO YOUR ANSWER

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

$f(2) = 10$

$g(f(2)) = g(10) = (10)^2$

$= \boxed{100}$

IN GENERAL **THE ORDER MATTERS**

$g \circ f(x)$ IS <u>NOT</u> THE SAME AS

$f \circ g(x)$

GRAPHING FUNCTIONS

- FUNCTIONS CAN BE GRAPHED ON THE X-AXIS AND Y-AXIS.

- REMEMBER THAT A FUNCTION IS A RULE THAT "maps" A PARTICULAR INPUT TO A PARTICULAR OUTPUT

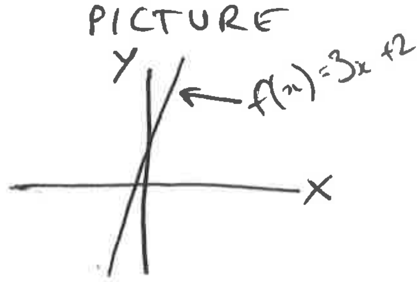
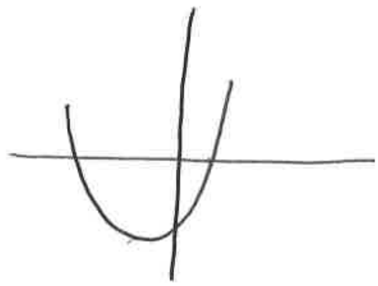
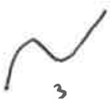
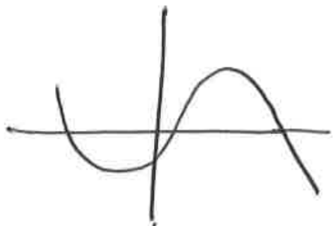
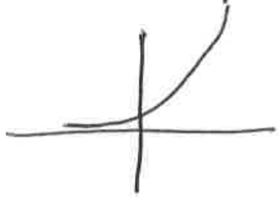
  INPUT ↑ x

  OUTPUT ← y

- THESE CAN BE WRITTEN AS PAIRS OF INPUTS + OUTPUTS. (x, y) OR $(x, f(x))$

- THESE POINTS CAN THEN BE PLOTTED ON X-AXIS / Y-AXIS, MAKING A CERTAIN SHAPE

- WE NEED TO BE FAMILIAR WITH 4 PARTICULAR TYPES OF FUNCTION:

	eg	PICTURE
① LINEAR (JUST x - NO x^2's etc) LOOKS LIKE A LINE	$y = 3x + 2$ OR $f(x) = 3x + 2$	
② QUADRATIC (x^2 IN IT) LOOKS LIKE U (x^2) OR ∩ ($-x^2$)	$f(x) = x^2 + 3x - 4$	
③ CUBIC (x^3 IN IT) LOOKS LIKE  ($-x^3$) OR  (x^3)	$f(x) = x^3 - 3x^2 + 2x + 4$	
④ EXPONENTIAL (x IN THE POWER)	$f(x) = 2(3^x)$	

TRANSFORMATIONS

[WHAT HAPPENS WHEN WE CHANGE THE ORIGINAL FUNCTION?]

[USE THE GRAPHING APPLETS ON THE WEBSITE]

- LINEAR ~ [EASY] – WE KNOW FROM CO-ORDINATE GEOMETRY THAT

$$y = \underset{\uparrow\ \text{SLOPE}}{mx} + \underset{\uparrow\ \text{Y-INTERCEPT}}{c}$$

SO IN OUR FUNCTIONS, IF WE CHANGE [eg $f(x) = 3x + 2$] THE NUMBERS, WE ARE ALTERING THE SLOPE OR THE Y-INTERCEPT.

- REMEMBER, PARALLEL LINES HAVE THE SAME SLOPE

- IF WE CHANGE THE "m" PART, THE SLOPE CHANGES
- IF WE PLAY AROUND WITH THE "+c" PART THE GRAPH MOVES UP OR DOWN

- QUADRATICS $y = ax^2 + bx + c$

– IF WE CHANGE a, THE GRAPH GETS STEEPER/NARROWER

– IF WE CHANGE c, THE GRAPH MOVES UP/DOWN

(DON'T WORRY ABOUT b)

$$y = (x + b)^2$$

– CHANGING b MOVES THE GRAPH LEFT/RIGHT.

CUBICS $y = ax^3 + bx^2 + cx + d$

- CHANGING d MOVES GRAPH ↑ OR ↓
- CHANGING a MAKES IT TALL + SKINNY OR SHORT + FAT.

(DON'T WORRY ABOUT b AND c)

$$y = (x + b)^3$$

→ AS WITH QUADRATICS, b MOVES THE GRAPH ← OR →

EXPONENTIAL $y = ak^x + b$

→ CHANGING a MAKES IT STEEPER

→ CHANGING b MOVES IT ↑ OR ↓

→ CHANGING x [THE POWER] MOVES GRAPH ← OR →

FOR ALL THESE TRANSFORMATIONS, TRY MAKING A TABLE + PLOTTING NEW GRAPHS TO GET AN IDEA OF THE NEW SHAPE