

Y2 E04 Math:

Graphs:

Equation of Straight line Graph: $y = mx + c$, where m is the gradient and c is the y -intercept

Equation of curved Graph: $y = ax^2 + bx + c$, where c is the y -intercept

Gradient = $\frac{y_2 - y_1}{x_2 - x_1}$ <choose any 2 points to sub in>

Holds true for
Straight line graph

Negative gradient = downwards sloping graph

Positive gradient = upwards sloping graph

$\rightarrow$ sub $y = 0$

x -intercept = point(s) where graph cuts x axis

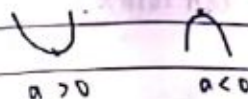
y -intercept = point(s) where graph cuts y -axis

$\rightarrow$ sub $x = 0$

In the equation $y = ax^2 + bx + c$,

if $a > 0$, the graph has a minimum point

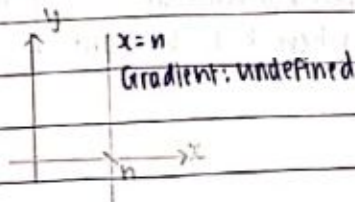
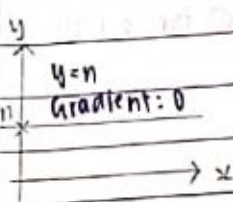
if $a < 0$, the graph has a maximum point



Y2 curved graphs are symmetrical.

Equation of Vertical straight line: $x = n$

Equation of horizontal straight line: $y = n$



How to find equation of line
of symmetry:

① use a & b to find c

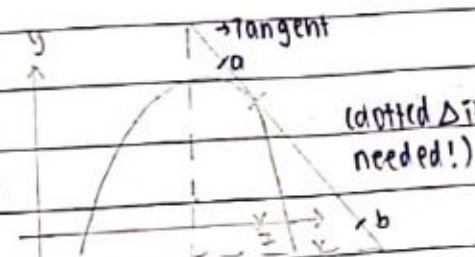
How: $\frac{a+b}{2}$

Eg. $a = 1$ and $b = 5$

$c = \frac{1+5}{2}$
 $= 3$

Tangent:

an. Find gradient
of line when $x = 7$



① Draw tangent (make sure it doesn't touch other
part of graph)

② Find coordinate of a & b

③ $\frac{y_2 - y_1}{x_2 - x_1}$

DRAW LINE AS LONG AS POSSIBLE TO MAKE LIFE EASIER!!!

c is midpoint of a & b

④ Line of symmetry $\Rightarrow x =$

<cher will accept range of ans so don't worry if ur ans p weird>



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By drawing a suitable line...

⊕ MAKE equation given in gn = equation of graph.

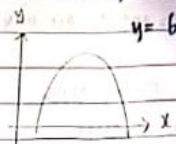
Eg. using ur graph, solve $y = 60x - \frac{x^2}{2} - 900$ by drawing a line

$$y = 60x - \frac{x^2}{2}$$

(credits 2019 MAM EGY that shit was hard)

$$x \Rightarrow 60x - \frac{x^2}{2} - 900 + 900 = 60x - \frac{x^2}{2}$$

Hence, draw $y = 900$ (IDK how to explain in words but yeah)



Graph Marking scheme: 1) x/y axis | origin | equation of curve 1m
 (based on what my cher said) 2) Points <All correct pls> 1m
 3) smoothness 1m

Udo, not spend 1 hour making the graph perfect please, it is only 1 mark. If you have a PRMC and the graph looks a bit off, just pray the cher will accept it. After all, it is just one mark so focus on the PRMC & other parts pls

Direct & Inverse proportion:

Direct proportion: $y = kx$, where k is constant

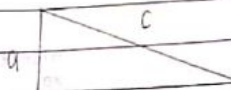
Inverse proportion: $y = \frac{k}{x}$, where k is constant

} pls write this for all gns to avoid P

Pythagoras Theorem:

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

$$c = \sqrt{a^2 + b^2}$$



Presentation: By Pythagoras Theorem...

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

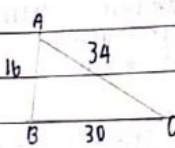
$$c^2 = \dots$$

} Identical Working (rearrange this the hard way)

Converse of Pythagoras Theorem

$$AC^2 = 34^2$$

$$= 1156$$



$$AB^2 + AC^2 = 16^2 + 36^2$$

$$= 1156^2$$

Since $AC^2 = AB^2 + BC^2$, By converse of Pythagoras Theorem, $\triangle ABC$ is a right-angled triangle.



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Only works for Δ
Trigonometric Ratios:

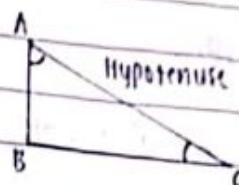
opp = opposite
adj = adjacent
hyp = hypotenuse

No:

Date:

TOA CAH SOH

$$\tan = \frac{\text{opp}}{\text{adj}} \quad \cos = \frac{\text{adj}}{\text{hyp}} \quad \sin = \frac{\text{opp}}{\text{hyp}}$$



Finding unknown angle

$$\angle X = \sin^{-1} \left(\frac{\text{opp}}{\text{hyp}} \right)$$

$$\angle Y = \cos^{-1} \left(\frac{\text{adj}}{\text{hyp}} \right)$$

$$\angle Z = \tan^{-1} \left(\frac{\text{opp}}{\text{adj}} \right)$$

$\angle ACB$: Adjacent = BC

Opposite = AB

$\angle BAC$: Adjacent = AB

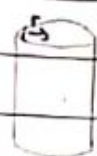
Opposite = BC

Hypotenuse is determined by Length

$$(\text{adj})^2 + (\text{opp})^2 = (\text{hyp})^2$$

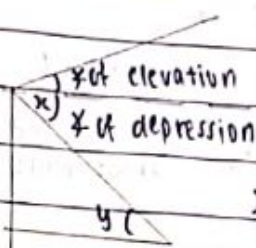
Volume and surface Area:

Cylinder: Volume = $\frac{1}{3} \times (\pi r^2) \times h$



Surface area = $\pi r h + 2\pi r^2$

Pipe: big cylinder - small cylinder

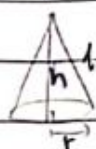


$$x = y$$

(Alternate angles)

Not drawn to scale

Cone: Volume = $\frac{1}{3} \times h \times (\pi r^2)$



Surface area = $\pi r^2 + \pi r l$

Use Pythagoras to find necessary elements

Sphere: Volume = $\frac{4}{3} \pi r^3$



Surface area = $4\pi r^2$

Hemisphere: Volume = $\frac{2}{3} \pi r^3$



Surface area = $2\pi r^2 + \pi r^2$

$$\left(\frac{1}{2} r \right) \left(\frac{1}{2} r \right) = \text{base area}$$

Prism: Surface area = All add together

Volume = depend on shape

Pyramid

Surface area = $4 \left(\frac{1}{2} \times s \times r \right) + \left(\frac{1}{2} r \right) \left(\frac{1}{2} r \right)$

Volume = $\frac{1}{3} \times h \times \left(\frac{1}{2} r \right) \left(\frac{1}{2} r \right)$



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Algebra:

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$(a+b)(a-b) = a^2 - b^2$$

1) Expand

2) Factorise

3) Simplify (can factorise units on say expand & simplify)

4) Make - subject of equation

Factorisation by grouping: $x^2 - 3x + 2xy - 6y$
 $= x(x-3) + 2y(x-3)$
 $= (x+2y)(x-3)$

$$\frac{(a+b)+3}{(a+b)}$$

cannot cancel (a+b)!!!
 (a+b) is not common factor

$$\frac{(a+b)(a+b)}{(a+b)}$$

yes cancel

$$5x^2 + 25x = 0$$

$$5x(x+5) = 0$$

$$5x = 0 \text{ or } x+5 = 0$$

$$x = 0 \text{ or } x = -5$$

must write

If an ask for a positive quantity:
 (eg. people, time)

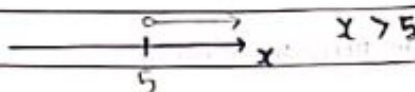
$x = -$ (rej because people > 0)

Pls read an !!

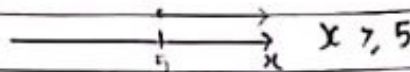
Linear Inequalities:

$>$ more than
 $\geq$ more than/equal to
 $<$ less than
 $\leq$ less than/equal to

1) at least $\geq$



2) cannot exceed $\leq$



3) at most $\leq$

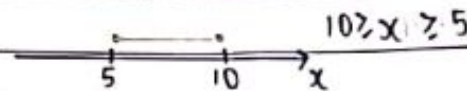
4) less than $<$

5) more than $>$

6) no less than $\geq$

7) no more than $\leq$

8) Must exceed $>$



→ solve separately!!

$$n_1 \leq n_2 > n_3$$

$$n_1 \leq n_2 \text{ and } n_2 > n_3$$



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Simultaneous Equations ① Elimination Method

Example: $70x + 74y = 4616$ - (1)

$x + y = 64$ - (2)

(1) $\times 70$: $70x + 70y = 4480$

(1) - (3): $4y = 136$

$y = 34$

Sub $y = 34$ into (2)

$x = 64 - 34$

$x = 30$

Therefore, $x = 30$ and $y = 34$

General Tips for Math:

① Read Qn carefully!

② Check 4 careless mistakes

<If no. is funny, check working>

③ Annotate!!!

④ Pythagoras & Trigo for Δ !!!

② Substitution Method:

$x - 2 = y + 3$ - (1)

$2x + 2y = 130$ - (2)

From (1): $x = y + 5$ - (3)

Sub (3) into (2)

$2(y + 5) + 2y = 130$

$4y + 10 = 130$

$4y = 120$

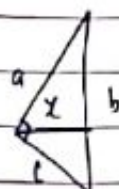
$y = 30$

Sub $y = 30$ into (2)

$2x + 60 = 130$

$2x = 70$

$x = 35$

Therefore, $x = 35$ and $y = 30$ Area of Δ

① $b \times x \times \frac{1}{2}$

② $a \times c \times \frac{1}{2}$

$3^2 = 9$, $3^3 = 27$, $3^4 = 81$, $3^5 = 243$

$4^2 = 16$

$5^2 = 25$

$6^2 = 36$

$7^2 = 49$

$8^2 = 64$

$9^2 = 81$

$10^2 = 100$

$11^2 = 121$

$12^2 = 144$

 π = calculator

Intermediate working

= 5 s.f / 3 d.p for Δ

Final ans

= 3 s.f / 1 d.p for Δ

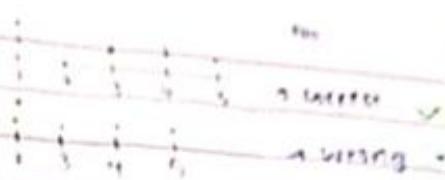
<Unless Qn

says otherwise>



- Statistics -

- 1) **Dot diagram** → see individual data
 - small set of data
 - Each dot is a value in data set
 - cannot have missing values
 - Intervals must be evenly marked out.

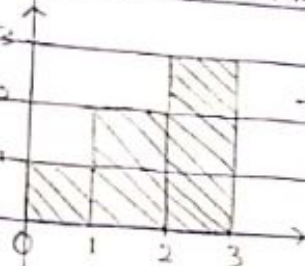
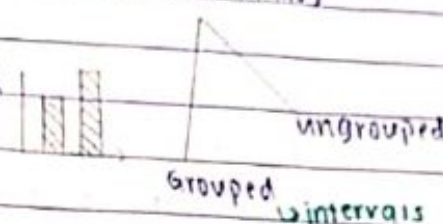


Describe distribution

- Range (minimum to maximum)
- Clusters (how the data is grouped about a certain value)
- Extreme values (value that deviates from others)
- Symmetry (shape)

outliers →

- 2) **Histogram** → unlike to see individual data
 - Large sets of data
 - unlike bar chart



→ Every bar must be of the same width!!
 * Equal width, then compare frequency.

- 3) **Stem and Leaf** → see individual data

(please write key in exam!)

Key examples:

- Grouped data
- usually small data → 2|3 means 23
- Must have a key → 1|4|2 means 142cm in height
- Stem must be in numerical order. → 4|7 means 4.7cm

- Leaf must be in ascending order.

- NO commas!

- 2 sided stem and leaf:

Ali	Kim or
10 4	123
200 5	222
10 6	577
0 7	

Stem	Leaf
10	1 2 3
11	0 0 1 1 2
12	4 5 7 7

Example of a Stem and Leaf diagram

Key: 10|1 means 10.1cm

Key: 7|4 = 74



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Mean → Another word for 'mean' is average.

$$\bar{x} = \frac{\sum fx}{\sum f}$$

(mean of a frequency distribution)

Median → The middle position of a data set

1) Odd number of data

To find the median,
arrange data set in ascending order!

1, 2, 3, 4, 5

3 is the median of the data set.

2) Even number data

↓

12, 15, 15, 20, 25, 32

Average of
2 numbers

$$\frac{15+20}{2} = 17.5$$

Most commonly
seen number.

17.5 is the median of the data set.

Mode → The number which appears the most in the data set. It has the highest frequency

↓ in the data set

Count. It sometimes, there will not be a mode!!

"bimodal"

1, 1, 2, 3, 3

→ both 1 and 3 are the mode

Important!

PN14

No. of houses	0	1	2	3	4
No. of student	2	x	3	4	1

$$a) \quad 1.8 = \frac{(0 \times 2) + (1 \times x) + (2 \times 3) + (3 \times 4) + (4 \times 1)}{2 + x + 3 + 4 + 1}$$

$$1.8 = \frac{x + 22}{x + 10}$$

$$x + 22 = 1.8x + 180$$

$$1.8x - x = 22 - 180$$

$$0.8x = 4$$

$$x = 5$$



Misreading Graphs

No:

Date: 13/08/20

Bar chart / Line graph

- Scale does not start at 0
- Vertical scale intervals made very small to make the difference in the data look very big.
- Numbers are skipped in the vertical axis.
- Data left out
- Graph is not labeled properly

Pie chart

- Pieces of a pie chart not at the correct sizes
- Percentage does not add up to 100%
- Graph does not have a title to explain what it is about

Pictographs

- Oversized volumes of objects that are too big for the vertical scale differences they represent.
- Sizes of images used are not in standard size or shape.

PN14 (cont.)

b) Greatest value of $x = 3\frac{1}{4}$

★
↓
important

c) 0...0 1...1 2...2 3...3 4...4
2 x 3 4 1

→ do not memorise answer!

If median is at the first value of 2

$$2 + x = 2 + 4 + 1$$

$$x = 5$$

→ maximum

If median is on the last value of 2

$$2 + x + 2 = 4 + 1$$

$$x = 1$$

→ minimum

Therefore, the possible values of x are 1, 2, 3, 4, 5.

PN16)

0 1 1 2 3 5
1.5 (median)

mean = 2

Sum of all numbers: 6×2

$$= 12$$

mode = 1

The numbers are 0, 1, 1, 2, 3 and 5.



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