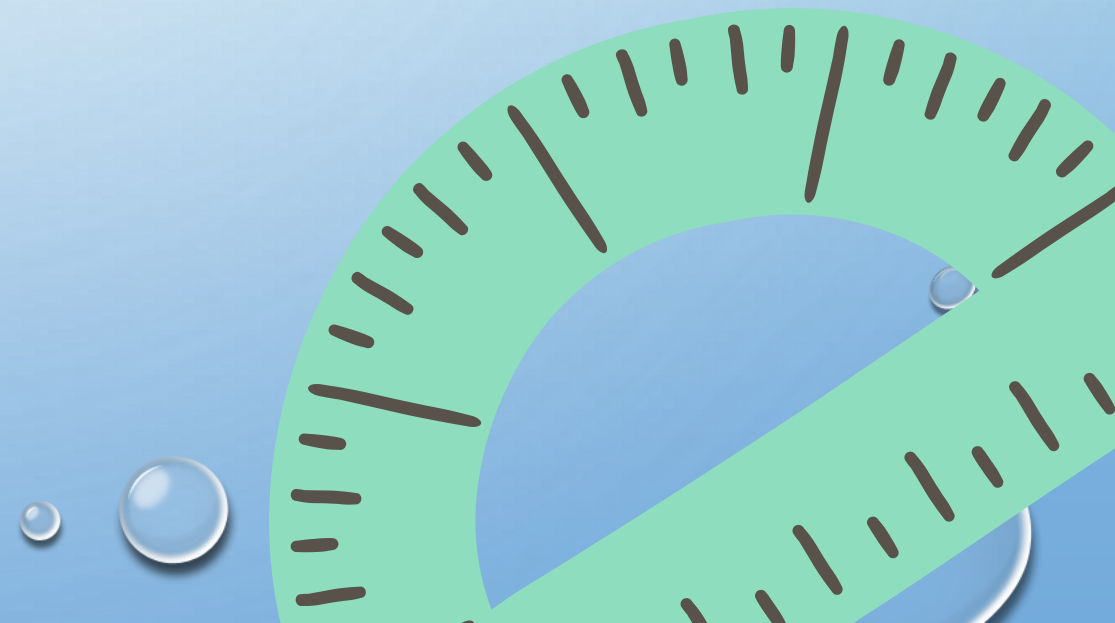
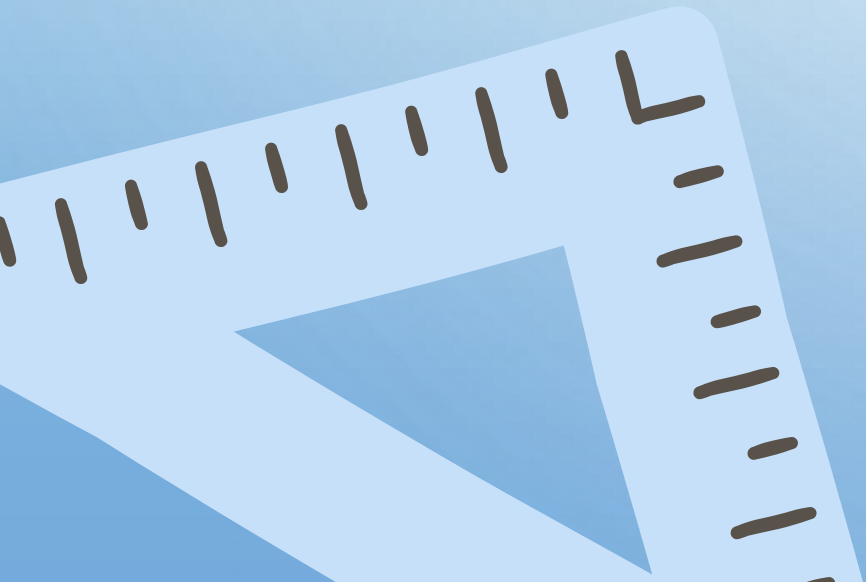




CHAPTER 1: QUADRATIC EQUATIONS





CHAPTER ANALYSIS

1

Finding the maximum or minimum value of a quadratic function using the method of completing the square.

2

Sketching of quadratic graphs with axial intercepts and turning points.

3

Conditions for my quadratic equation to be always positive or always negative.





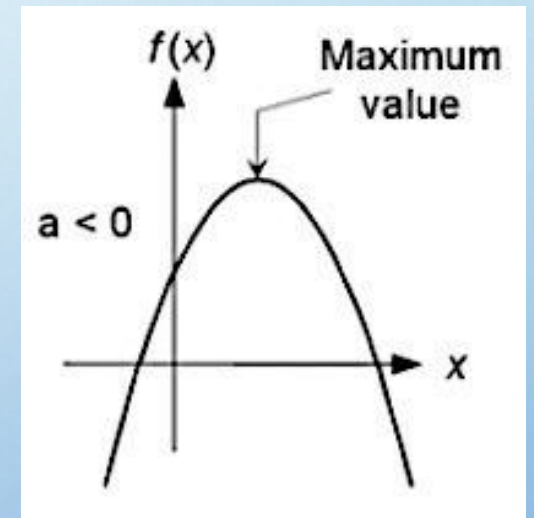
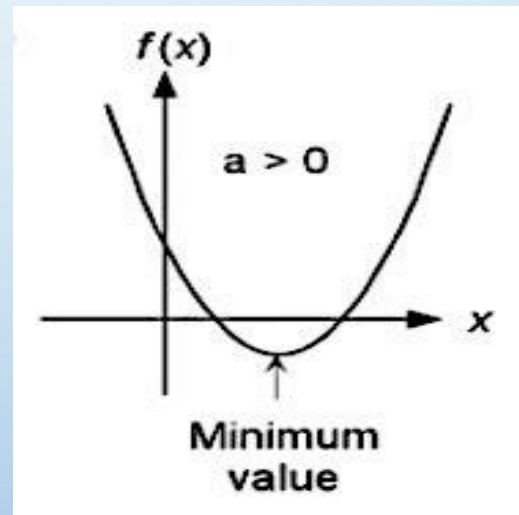
QUADRATIC FUNCTIONS

- A quadratic equation is in the form of $y = ax^2 + bx + c$, where a , b and c are constants.

Maximum / minimum point

Also known as the “Turning Point” or “Vertex” of a graph

Signature	Point
Positive ($a > 0$)	Minimum Point
Negative ($a < 0$)	Maximum Point





FINDING THE MAXIMUM AND MINIMUM POINT

Steps

In terms of the general case:

$$\begin{aligned}f(x) &= ax^2 + bx + c \\&= a\left(x^2 + \frac{b}{a}x\right) + c \\&= a\left[\left(x + \frac{b}{2a}\right)^2 - \left(\frac{b}{2a}\right)^2\right] + c \\&= a\left(x + \frac{b}{2a}\right)^2 + \left[c - a\left(\frac{b}{2a}\right)^2\right] \\&= a(x - h)^2 + k\end{aligned}$$

Real example:

$$\begin{aligned}f(x) &= x^2 + 9x + 12 \\&= \left(x + \frac{9}{2}\right)^2 - \left(\frac{9}{2}\right)^2 + 12 \\&= \left(x + 4\frac{1}{2}\right)^2 - 8\frac{1}{4}\end{aligned}$$

Important

Students must know how to deal with these 2 cases with factorising

- Coefficient of x^2 is negative

$$-x^2 + bx + c = -(x^2 - bx - c)$$

- Coefficient of x^2 is not 1

$$ax^2 + bx + c = a\left(x^2 + \frac{b}{a}x\right) + c$$

1) Complete the square

- When we complete the square and achieve the form of $y = a(x - h)^2 + k$, we are able to derive our turning point.

Coordinates of turning point = (h, k)

*Tip: Let the bracket (x - h) to be equals to 0.

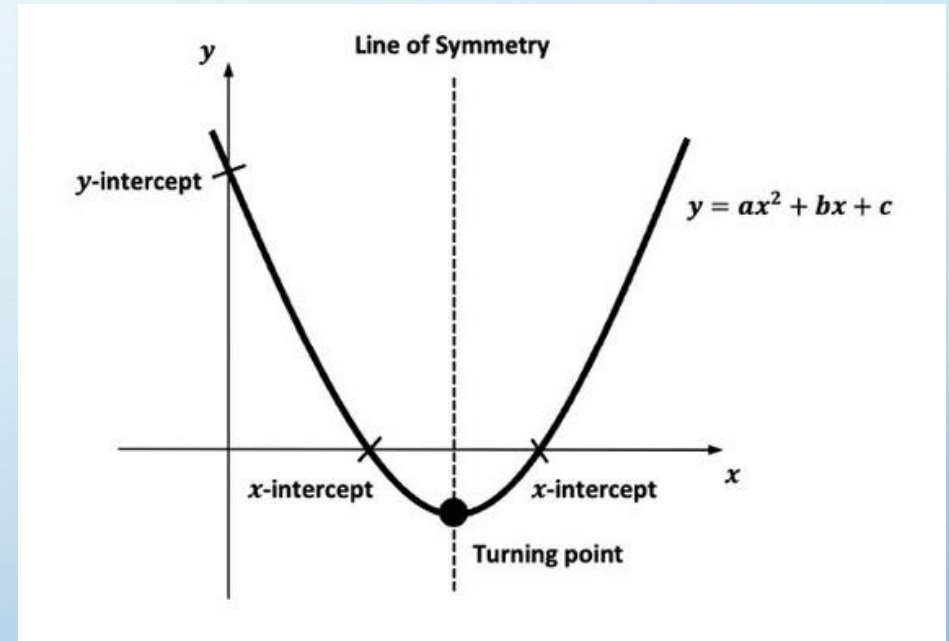
2) Using the line of symmetry

- Once we derive our x-intercepts, we can compute the line of symmetry by finding the midpoint: $\frac{x_1 + x_2}{2}$, where x_1 and x_2 are the x-intercepts.
- Sub in the value of x found from the previous step into the equation and find the value of y.

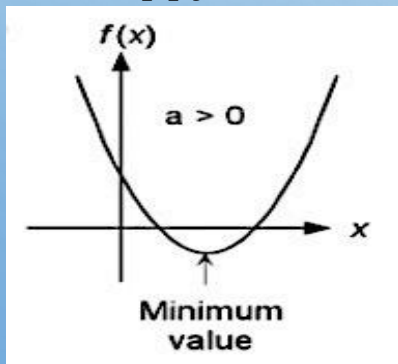


SKETCHING OF QUADRATIC GRAPH

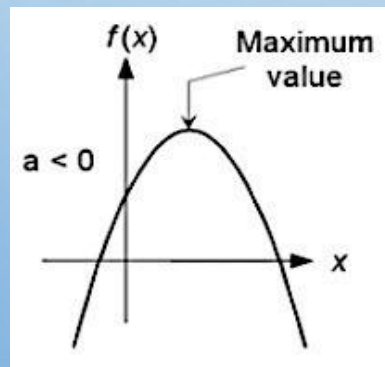
- To find the x -intercept, sub $y = 0$.
- To find the y -intercept, sub $x = 0$.
- To find the turning point, use either Complete the square or finding the line of symmetry (Refer to previous page)
- To determine the shape of the graph, we look at the coefficient of x^2 .
 - If the coefficient of x^2 is more than 0, it is a happy face.
 - If the coefficient of x^2 is less than 0, it is a sad face.



Happy Face



Sad Face





Conditions to be always positive or always negative

Method 1: Complete the square

- When we complete the square and achieve the form of $y = a(x - h)^2 + k$, we can identify the maximum or minimum point.
- If the maximum point of the graph is below the x -axis, there will not be any intersections between the curve and the x -axis, therefore the graph will always be negative as it will always be below the x -axis.
- If the minimum point of the graph is above the x -axis, there will not be any intersections between the curve and the x -axis, therefore the graph will always be positive as it will always be above the x -axis.

Method 2: Discriminant (This is covered in Chapter 2 so stay tune for our next chapter!)

- Conditions for always positive:
 - The coefficient of x^2 is more than 0 AND the discriminant (always known as $b^2 - 4ac$) is lesser than 0.
- Conditions for always negative:
 - The coefficient of x^2 is less than 0 AND the discriminant (always known as $b^2 - 4ac$) is lesser than 0.



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07

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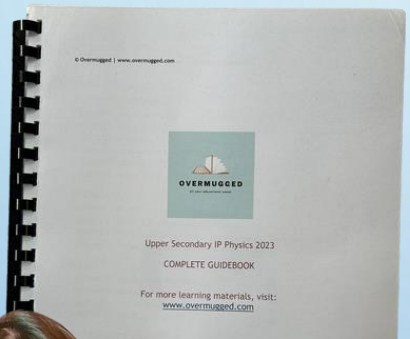
WEEKLY WORKSHEETS

Topical, Thematic, Mock Test, Mock Exam,
Prelim Prep, Practical Prep



EXCLUSIVE CHEATSHEETS

Revision booklets, extra cheatsheets,
Practical Assessment booklet



TOPIC: KINEMATICS			
Concept	Definition	Formula	Remarks
Linear motion	<ul style="list-style-type: none"> Object that is moving in a straight line 1-D motion 	$v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$	<ul style="list-style-type: none"> Motion can be represented (upwards or right) or -ve (down or left) sign. Equations can only be used if acceleration is constant.
Projectile motion	<ul style="list-style-type: none"> Object that is moving in a projectile trajectory (x and y directions) 2-D motion Acceleration is experienced in both axes Vertical and horizontal motion are independent of each other 	<p>Horizontal motion (acceleration = 0)</p> $v_x = u_x$ $s_x = u_x t$ <p>Vertical motion (uniform vertical acceleration = g)</p> $v_y = u_y + at$ $s_y = u_y t + \frac{1}{2}at^2$ $v_y^2 = u_y^2 + 2as$	<ul style="list-style-type: none"> Acceleration always act down Projectile will free fall and parabolic if resistance is negligible
Vector resolution	Analyse the horizontal and vertical motion separately	<p>For a vector \vec{v} pointing at an angle θ from the horizontal:</p> $v_x = v \cos\theta$ (horizontal) $v_y = v \sin\theta$ (vertical) $v = \sqrt{v_x^2 + v_y^2}$ $\tan\theta = \frac{v_y}{v_x} \Rightarrow \theta = \tan^{-1}\left(\frac{v_y}{v_x}\right)$	

MARCH PRACTICE QUESTIONS 2021
SECONDARY 4 EXPRESS
SECONDARY 5 NORMAL ACADEMIC

ELEMENTARY MATHEMATICS 4048/01

Specimen Paper
Date: 7 March 2021
Candidates answer on separate writing paper

Duration: Nil

READ THESE INSTRUCTIONS FIRST

Answer all questions.
If working is needed for any question it must be shown with the answer.
Candidates of normal working will result in loss of marks.
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures.
Give answers in degrees to one decimal place.
For π , use either your calculator value of 3.142, unless the question requires the answer in terms of π .

Topic names will be listed above each question for your benefit and revision.

Upon completion of solutions:
Each candidate have exactly 2 weeks to submit their solutions.
Take a picture or send the digital version of your solutions to me (Kallian) via Telegram @kallian_tutani or WhatsApp (9053377).
Ensure that all workings are clear and legible.
Solutions will be marked based on your presentation, accuracy and completeness of your solutions.
A markers' report and the full solutions will be provided at the end of the month.

Author: Ong Kai Wan
This question paper consists of 3 printed pages including the cover page.

Time taken to reach a maximum height H when $v_y = 0$	$v_y^2 = (u \sin\theta)^2 - 2gH$ $\therefore H = \frac{u^2 \sin^2\theta}{2g}$	With air resistance, <ul style="list-style-type: none"> Drag force acts in the same as the weight of object. Net acceleration $>> g$ Maximum height reached lower.
Time taken to reach a maximum height H when $v_y = 0$	$v_y = u \sin\theta - gt_{up}$ $\therefore t_{up} = \frac{u \sin\theta}{g}$	With air resistance, <ul style="list-style-type: none"> Drag force acts in the same as the weight of object. Net acceleration $>> g$ Final vertical speed smaller than vertical speed Average speed upwards $>> g$

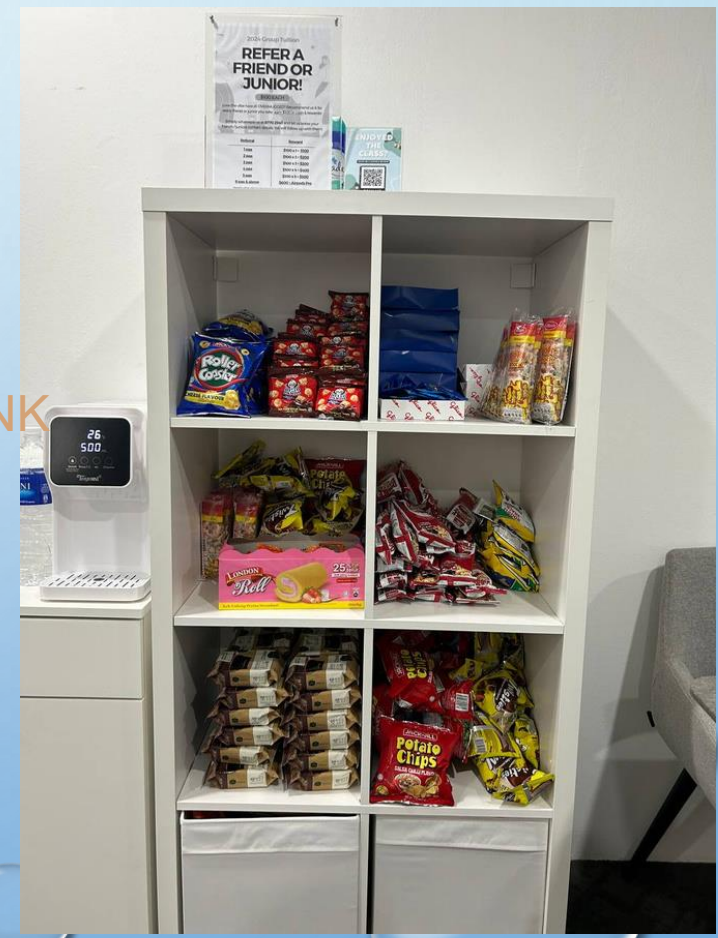




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- 10% if signing up for 2 'A' Levels subject & above*

Fees are collected at the start of the term (every 3 months).



ACADEMIC YEAR

TERM 1: NOV - JAN

Topical Recaps

Key highlight: Christmas Party

TERM 2: FEB - APR

Topical Mastery

Key highlight: March Holiday Cohesion Program

TERM 3: MAY - JUL

Prelim/EOY Preparation

Key highlight: Mock Prelim/EOY

TERM 4: AUG - OCT

'O' Levels / 'A' Levels Preparation

Key highlight: Mock Exams, Science Practical Assessment





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