

UNIT 3A MATHEMATICS EXAMINATION

SOLUTIONS

SECTION A NON-CALCULATOR SECTION

STUDENT'S NAME \_\_\_\_\_

TEACHER:- Belonogoff Goh Hampson  
(Circle one name) Knoblauch Lee Robinson

TIME ALLOWED FOR THIS PAPER

Reading time before commencing Section A	Five minutes
Working time for Section A (non calculator)	Forty minutes
Changeover time between Sections A and B	Five minutes
Reading time before commencing Section B	Five minutes
Working time for Section B	Eighty minutes

Available marks for Section A:	40 marks
Available marks for Section B:	80 marks

**MATERIAL REQUIRED / RECOMMENDED FOR THIS PAPER**

TO BE PROVIDED BY THE SCHOOL:

This Question/Answer booklet

TO BE PROVIDED BY THE CANDIDATE

*Standard Items*

Pens, pencils, eraser, ruler

*Special items*

Curriculum Council Mathematical Formulae and Statistics Tables Book, drawing instruments, templates, notes on two sheets (4 sides) of A4 paper and calculators (Section B only) satisfying the conditions set by the Curriculum Council.

NOTE: Personal copies of the Tables Book should not contain any handwritten notes, symbols, signs, formulae or any other marks (including underlining and highlighting), except the name and address of the candidate, and may be inspected during the examination.

**IMPORTANT NOTE TO CANDIDATES**

**No other items may be taken into the examination room.**

**It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor BEFORE reading any further.**

## STRUCTURE OF THIS PAPER

This paper consists of two sections:

**Section A** is a non-calculator section – **no** calculator may be used in this section. Time allowed for this section is 40 minutes. At the end of 40 minutes, this section will be collected by the supervisor. There will be a 5 minute changeover before commencing Section B.

**Section B** is a section where approved calculators are permitted. Time allowed for this section is 80 minutes. At the end of 80 minutes, this section will also be collected by the supervisor.

## INSTRUCTIONS TO CANDIDATES

**ALL** questions should be attempted. You may answer the questions in any order you wish.

Write answers in the spaces provided. Extra pages are supplied at the back of this booklet. If the extra pages are used, label the questions clearly. Indicate on the original question that your working continues at the end of this booklet.

**Show all working clearly**, in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. If you repeat an answer to any question, ensure that you cancel the answers you do not wish to have marked.

<b>Question</b>	<b>Total</b>	<b>Mark</b>
1	5	
2	2	
3	4	
4	2	
5	3	
6	7	
7	3	
8	3	
9	2	
10	2	
11	4	
12	3	
<b>Total</b>	<b>40</b>	

## SECTION A

NO CALCULATORS PERMITTED FOR THIS SECTION

TIME 40 minutes

AVAILABLE MARKS 40 marks

Some formulae you might find useful:

$$\text{Area of triangle} = \frac{ab \sin C}{2}$$

$$\text{Sine rule} \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$

Some trigonometry ratios which might be useful:

	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0

Question 1 (2, 3 marks)

(a) Solve  $(x+1)^{\frac{3}{2}} = 125$

$$x+1 = \left(\sqrt[3]{125}\right)^2 \quad \checkmark$$
$$x+1 = 25$$
$$x = 24 \quad \checkmark$$

(b) Simplify  $\frac{3^{n-1} + 3^n}{12 \times 3^{n-1}}$  giving answers in positive indices.

$$= \frac{3^{n-1} (1+3)}{3^{n-1} (12)} \quad \checkmark$$

$$= \frac{4}{12}$$

$$= \frac{1}{3} \quad \checkmark$$

5

Question 2 (2 marks)

Simplify, expressing your answer in positive indices.

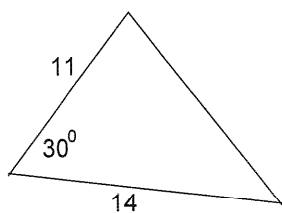
$$\frac{36(a^2)^3 b^9}{28 a^{-3} b^{12}}$$
$$= \frac{9}{7} a^{6+3} b^{9-12} \quad \checkmark$$
$$= \frac{9a^9}{7b^3} \quad \checkmark$$

(2)

Question 3 (2, 2 marks)

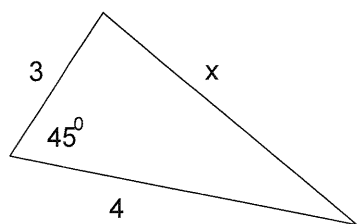
Give answers in **exact values** with a rational denominator. All measurements are in cm.

(a) Find the area of the triangle below.



$$\text{Area}(\Delta) = \frac{1}{2} \times 11 \times 14 \times \sin 30^\circ$$
$$= \frac{1}{2} \times 11 \times 14 \times \frac{1}{2} \quad \checkmark$$
$$= 38.5 \text{ cm}^2 \quad \checkmark$$

(b) Find the value of x



$$x^2 = 3^2 + 4^2 - 2(3)(4) \cos 45^\circ$$
$$= 9 + 16 - 24 \cdot \frac{1}{\sqrt{2}} \quad \checkmark$$
$$= 25 - \frac{24 \cdot \sqrt{2}}{\sqrt{2} \sqrt{2}} \quad \checkmark$$
$$x = \sqrt{25 - 12\sqrt{2}} \text{ cm} \quad \checkmark$$

(4)

Question 4 (2 marks)

A small high school runs two 3A Mathematics classes. Following a test, the mean mark of the first class of 18 students is 82 and the mean mark of the other class of 25 students is 74.

**Explain** how the combined mean mark of these two classes would be calculated. (You are not required to calculate it.)

Find total marks of class 1    ie:  $\bar{x}$  class 1  $\times$  number  
 $= 82 \times 18$

Find total marks of class 2    ie:  $74 \times 25$

Combined mean     $= \frac{(82 \times 18) + (74 \times 25)}{18 + 25}$  ✓

②

Question 5 (1, 2 marks)

If digits can only be used **once**.

(a) How many 4 digit odd numbers can be made using the digits 2, 3, 4, 5, 6?

$\underline{4} . \underline{3} . \underline{2} . \underline{2} = 48$  ✓

(b) How many of the above numbers are greater than 5000?

end in 5     $\underline{1} . \underline{3} . \underline{2} . \overset{\uparrow}{\underline{5}} = 6$  } or beg. = 5     $\underline{1} . \underline{3} . \underline{2} . \underline{1} = 6$

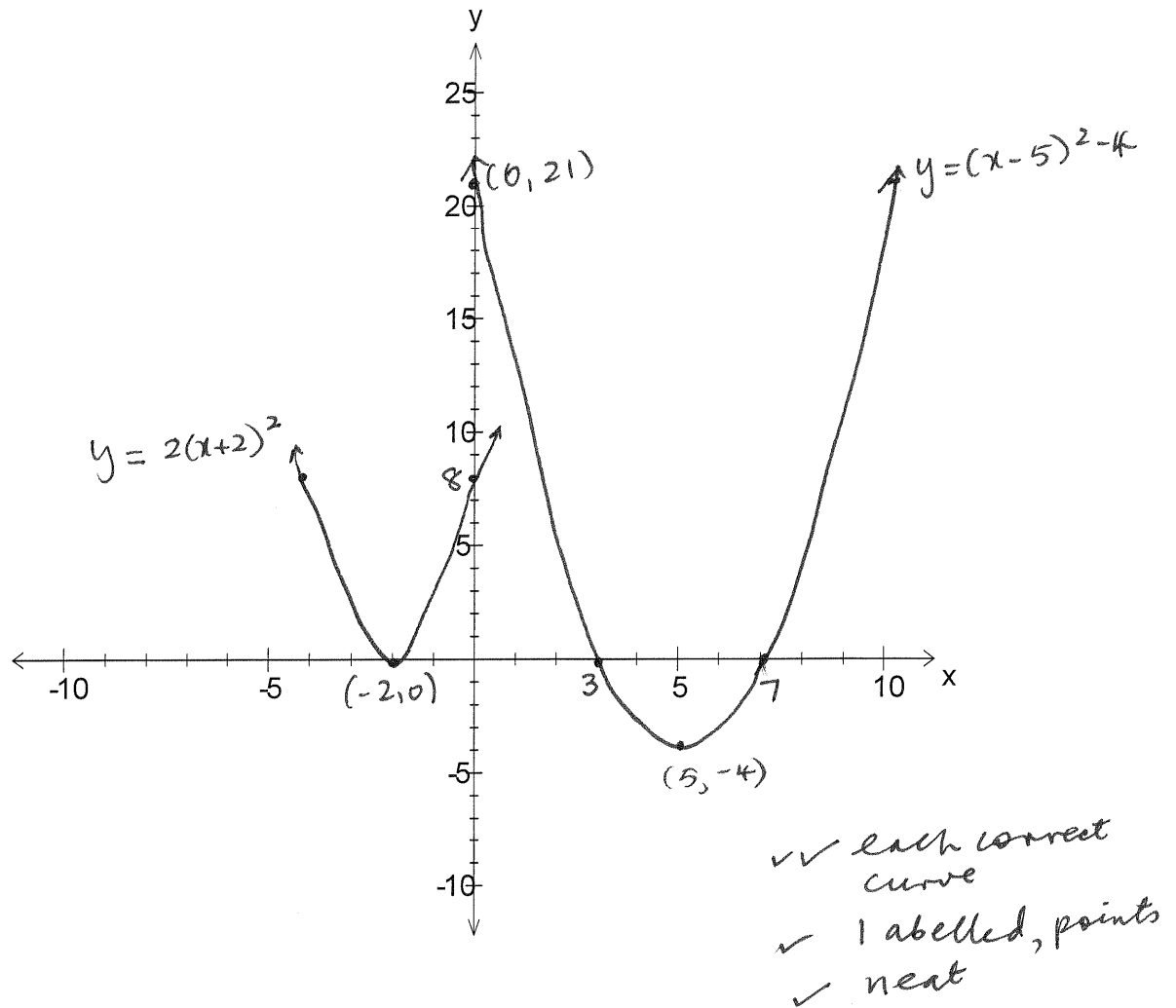
end in 3     $\underline{2} . \underline{3} . \underline{2} . \overset{\uparrow}{\underline{5}} = 12$  } ✓    beg. = 6     $\underline{1} . \underline{3} . \underline{2} . \underline{2} = 12$

altog. 18 numbers ✓

③

Question 6 (7 marks)

Describe how the graph of  $y = 2(x + 2)^2$  compares to that of  $y = (x - 5)^2 - 4$ .  
Draw well-labelled sketches of each curve on the same set of axes to support your answer.



$y = 2(x+2)^2$  is the curve of  $y = (x-5)^2 - 4$  which has been translated 7 units left, 4 units up, dilated parallel to the y axis, scale factor 2. ✓

Question 7 (3 marks)

Nine numbers have a mean of  $m$ . When a tenth number is added, the mean of all ten is  $(m - 0.4)$ . What is the tenth number in terms of  $m$ ?

$$\begin{aligned} \text{Sum of 9 numbers} &= 9m \\ \text{Sum of 10 numbers} &= 10m - 4 \\ \text{10th number} &= 10m - 4 - 9m \\ &= m - 4 \end{aligned} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \begin{array}{l} \checkmark \\ \checkmark \\ \checkmark \end{array}$$

(3)

Question 8 (3 marks)

A sequence has the recursive formula  $T_{n+1} = (2)^{-n} T_n$  with  $T_2 = 4$ , find  $T_1$ ,  $T_3$  and  $T_4$  of the sequence.

$$\begin{aligned} T_{n+1} &= 2^{-n} \cdot T_n \\ T_2 &= 2^{-1} \cdot T_1 \\ 4 &= \frac{1}{2} \cdot T_1 \\ T_1 &= 8 \quad \checkmark \\ T_3 &= 1 \quad \checkmark \\ T_4 &= \frac{1}{8} \quad \checkmark \end{aligned}$$

(3)

Question 9 (2 marks)

Write the recursive rule for the sequence below

$$27, -18, 12, -8, 5\frac{1}{3}, \dots$$

$$\begin{aligned} r &= \frac{-18}{27} \\ &= -\frac{2}{3} \end{aligned}$$

$$T_{n+1} = -\frac{2}{3} T_n, \quad T_1 = 27 \quad \checkmark \quad \checkmark$$

(2)



Question 10 (2 marks)

Su-lin's standardised score in a Mathematics test was 1.4. The mean and standard deviation for the class were 66% and 5.5% respectively. What was Su-lin's raw percentage mark?

$$Z = \frac{x - \bar{x}}{s}$$

$$1.4 = \frac{x - 66}{5.5}$$

$$7.7 = x - 66$$

$$73.7\% = x$$

Su-lin's <sup>raw</sup> percentage mark was 73.7% ✓ (2)

Question 11. (4 marks)

The following scores are arranged in ascending order

a    3    4    5    5    |    b    7    8    8    9

range = 7    median = 5.5

Find a and b and draw a box and whisker diagram for the above ten scores on the axis.

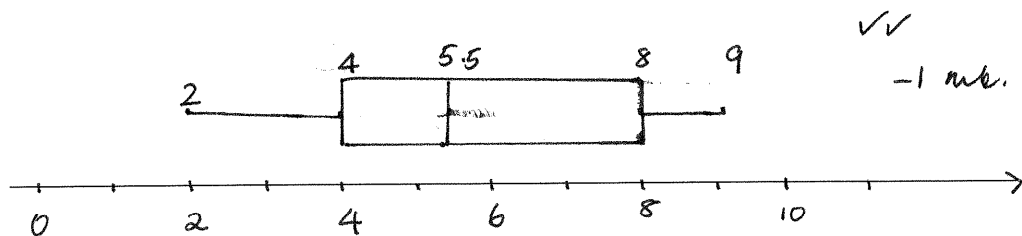
$$a = 2$$

✓

$$\frac{5+b}{2} = 5.5 \text{ (median)}$$

$$b = 6$$

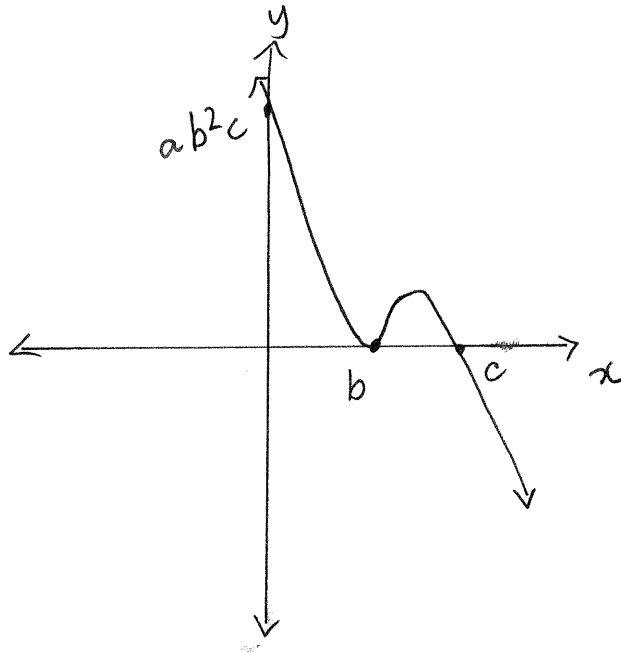
✓



(4)

Question 12 (3 marks)

Given that  $a$ ,  $b$  and  $c$  are all positive integers, draw a graph that best represents  $y = a(x-b)^2(c-x)$ . Label all the intercepts.



✓ shape  
✓✓ 3 intercepts labelled  
(if 2 intercepts ✓ x  
< 2 intercepts xx)

③

End of Part A

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