

Rossmoyne Senior High School

Semester One Examination, 2015

Question/Answer Booklet

MATHEMATICS 3A

Section One:
Calculator-free

SOLUTIONS

Student Number: In figures

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In words

Your name

Time allowed for this section

Reading time before commencing work: five minutes

Working time for this section: fifty minutes

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer Booklet

Formula Sheet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,
correction fluid/tape, eraser, ruler, highlighters

Special items: nil

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

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	7	7	50	50	33 $\frac{1}{3}$
Section Two: Calculator-assumed	13	13	100	100	66 $\frac{2}{3}$
Total				150	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2015*. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer Booklet.
3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.
4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.
5. **Show all your working clearly.** Your working should be 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. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.
6. It is recommended that you **do not use pencil**, except in diagrams.
7. The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

Section One: Calculator-free

(50 Marks)

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 50 minutes.

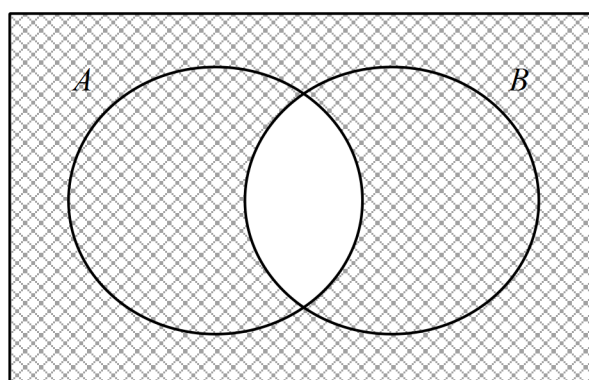
Question 1

(4 marks)

Shade the region in each Venn diagram below to represent

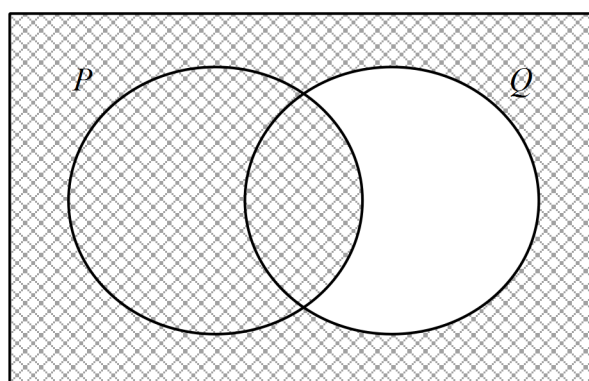
(a) $\overline{A \cap B}$.

(2 marks)



(b) $P \cup \overline{Q}$.

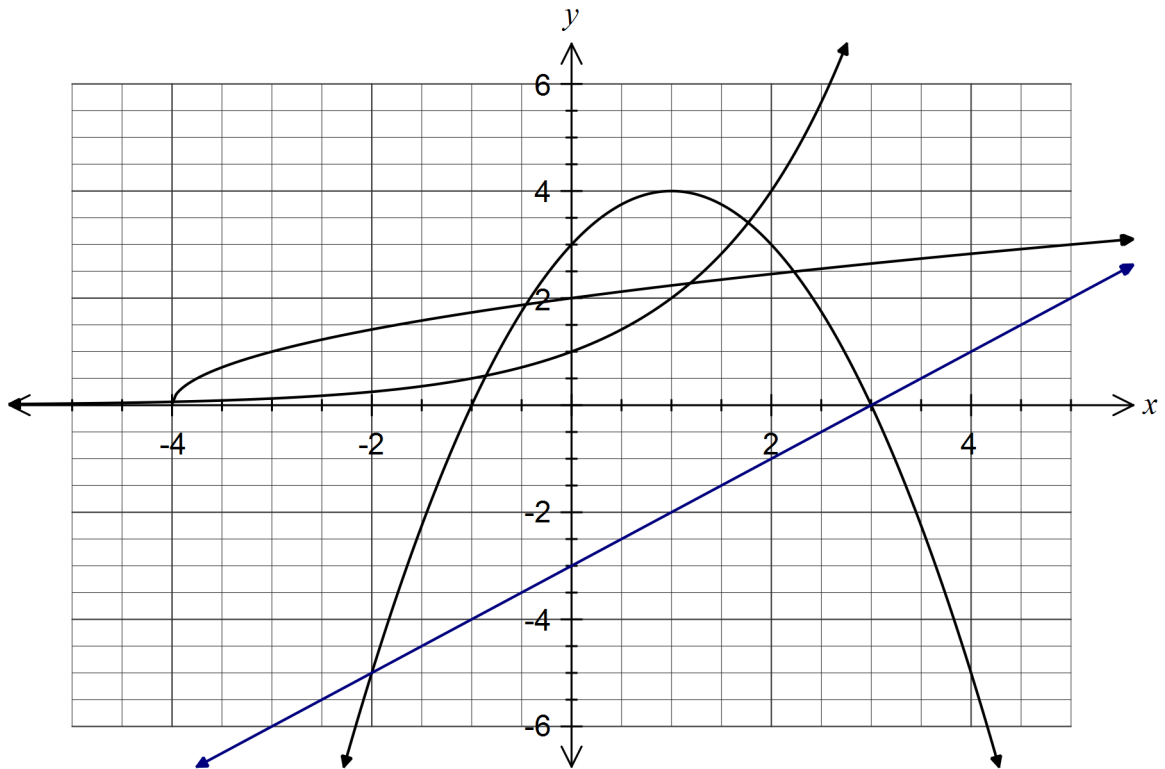
(2 marks)



Question 2

(9 marks)

The functions $f(x) = 4 - (x - 1)^2$, $g(x) = 2^x$ and $h(x) = \sqrt{x + 4}$ are graphed below.



- (a) One of the functions has an asymptote. State the equation of this asymptote. (1 mark)

Function g has asymptote with equation $y = 0$.

- (b) One of the functions has a line of symmetry. State the equation of this line of symmetry. (1 mark)

Function f has line of symmetry $x = 1$.

(c) Use the graph to solve the following equations.

(i) $\sqrt{x+4} = 2^x$, for $-4 \leq x \leq 4$. (2 marks)

$$\begin{aligned} x &\approx -4 \\ x &\approx 1.2 \end{aligned}$$

(ii) $2^x = 4 - (x-1)^2$, for $x \geq 0$. (2 marks)

$$\begin{aligned} x &\approx 0.9 \text{ (Outside dom)} \\ x &\approx 1.8 \end{aligned}$$

(iii) $4 - (x-1)^2 - x + 3 = 0$, for $-4 \leq x \leq 4$, by drawing a suitable straight line on the graph. (3 marks)

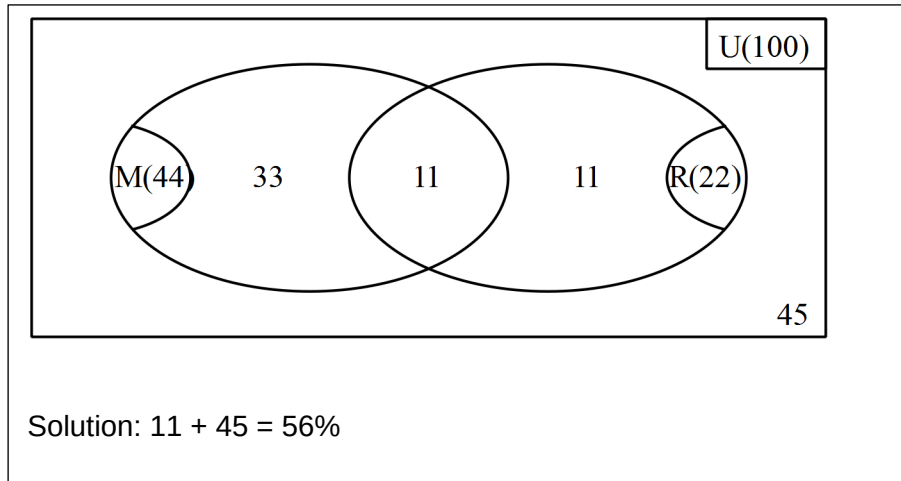
$$\begin{aligned} 4 - (x-1)^2 - x + 3 &= 0 \Rightarrow y = x - 3 \\ x &= -2 \\ x &= 3 \end{aligned}$$

Question 3

(5 marks)

44% of students enrolled in a math course at a university were male. 22% of the students enrolled were retaking the course and of these students, half were female.

- (a) Determine the percentage of enrolled students in the math course who were males retaking the course or females not retaking the course. **(3 marks)**



- (b) Determine the probability that a randomly chosen female student enrolled in the course was retaking it. **(2 marks)**

$$\frac{11}{45 + 11} = \frac{11}{56}$$

Question 4

(9 marks)

Solve the following equations for x .

(a) $x^2 - 5x - 24 = 0$.

(2 marks)

$$(x + 3)(x - 8) = 0$$

$$x = -3, x = 8$$

(b) $-2x^2(2 - 5x) = 0$.

(2 marks)

$$-2x^2 = 0 \Rightarrow x = 0$$

$$2 - 5x = 0 \Rightarrow x = \frac{2}{5}$$

(c) $(x - 3)^2 = 4$.

(2 marks)

$$x - 3 = \pm 2$$

$$x = 3 + 2 = 5$$

$$x = 3 - 2 = 1$$

(d) $x(x - 1) = (x + 6)(1 - x)$.

(3 marks)

$$x^2 - x = x - x^2 + 6 - 6x$$

$$2x^2 + 4x - 6 = 0$$

$$x^2 + 2x - 3 = 0$$

$$(x + 3)(x - 1) = 0 \Rightarrow x = -3, x = 1$$

Question 5

(8 marks)

The duration of telephone calls to a call centre are normally distributed with a mean of 225 seconds and a standard deviation of 35 seconds. All calls are recorded for training purposes.

(a) Determine the probability that a randomly chosen call from the records has a duration of

(i) between 120 and 330 seconds.

(1 mark)

$$\bar{x} \pm 3sd = 225 \pm 105 \Rightarrow (120, 330)$$

$$P = 0.997$$

(ii) more than 260 seconds.

(2 marks)

$$\bar{x} + 1sd = 225 + 35 = 260$$

$$P = 0.5 - (0.68 \div 2)$$

$$= 0.16$$

(b) If 50 calls were randomly selected from the records, how many would be expected to have a duration of between 190 and 260 seconds? (2 marks)

$$\bar{x} \pm 1sd = 225 \pm 35 \Rightarrow (190, 260)$$

$$P = 0.68$$

$$n = 0.68 \times 50 = 34 \text{ calls}$$

(c) At a similar call centre, the duration of calls were also normally distributed. Records showed that 68% of calls were between 165 and 195 seconds and 95% of calls were between 150 and 210 seconds. Use this information to estimate the mean and standard deviation of the duration of calls at this centre. (3 marks)

$$\frac{165 + 195}{2} = \frac{360}{2} = 180$$

$$\frac{150 + 210}{2} = \frac{360}{2} = 180$$

Hence deduce that $\bar{x} = 180$ calls from the s

From 68% rule, $sd = 195 - 180 = 15$ calls

Question 6

(9 marks)

(a) Evaluate $\left(\frac{3^{-2}}{4^{-1}}\right)^2$.

(2 marks)

$$\left(\frac{4}{3^2}\right)^2 = \left(\frac{4}{9}\right)^2 = \frac{16}{81}$$

(b) Simplify $\left(\frac{2xy}{3y^2}\right)^2$.

(2 marks)

$$\left(\frac{2x}{3y}\right)^2 = \frac{4x^2}{9y^2}$$

(c) Solve the following equations for x .

(i) $6x^{\frac{1}{4}} - 3 = 9$.

(2 marks)

$$\begin{aligned} x^{\frac{1}{4}} &= 2 \\ x &= 2^4 \\ &= 16 \end{aligned}$$

(ii) $1000^{2-x} = 100^{2x+1}$.

(3 marks)

$$\begin{aligned} 10^{3(2-x)} &= 10^{2(2x+1)} \\ 6-3x &= 4x+2 \\ 7x &= 4 \\ x &= \frac{4}{7} \end{aligned}$$

Question 7

(6 marks)

- (a) In triangle ABC , $\cos A = \frac{3}{4}$ cm, $b = 3$ cm and $c = 2$ cm. Determine the length of side a .
(2 marks)

$$\begin{aligned} a^2 &= 3^2 + 2^2 - 2 \times 3 \times 2 \times \cos A \\ &= 9 + 4 - 12 \times \frac{3}{4} \\ &= 4 \\ a &= 2 \text{ cm} \end{aligned}$$

- (b) In triangle DEF , the length of the sides DF and FE are 8 cm and 16 cm respectively. If the value of $\sin D = 0.8$, determine the value of $\sin E$.
(2 marks)

$$\begin{aligned} \frac{e}{\sin E} &= \frac{d}{\sin D} \Rightarrow \frac{8}{\sin E} = \frac{16}{0.8} \\ \sin E &= 0.4 \end{aligned}$$

- (c) In triangle PQR , $\sin P = 0.5$ and the lengths of PQ , PR and QR are 14 cm, 12 cm and 7 cm respectively. Determine the area of the triangle.
(2 marks)

$$\begin{aligned} \text{Area} &= \frac{1}{2} \times PQ \times PR \times \sin P \\ &= \frac{1}{2} \times 14 \times 12 \times \frac{1}{2} \\ \text{Area} &= 42 \text{ cm}^2 \end{aligned}$$

Additional working space

Question number: _____

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