Rossmoyne Senior High School

Year 12 Trial WACE Examination, 2014

Question/Answer Booklet

MATHEMATICS 3A/3B
Section One:
Calculator-free

SOLUTIONS

Student Number: In figures | | | | | | | | |

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, pencils, pencil sharpener, eraser, correction fluid/tape, ruler, highlighters

Special items: nil

Important note to candidates

No other items may be used in this section of the examination. 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	6	6	50	50	33⅓
Section Two: Calculator-assumed	13	13	100	100	66⅔
			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 2013*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in the spaces provided in this Question/Answer Booklet. 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(s) that you are continuing to answer at the top of the page.

3. **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 an answer to any question, ensure that you cancel the answer you do not wish to have marked.

4. It is recommended that you **do not use pencil**, except in diagrams.

See next page

Section One: Calculator-free **(50 Marks)**

This section has **six (6)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 50 minutes.

Question 1 **(7 marks)**

(a) Use the laws of indices to simplify

(i) $\left(\frac{2}{3}\right)^3 \times \left(\frac{4}{3}\right)^{-2}$. (2 marks)

$$\left(\frac{2}{3}\right)^3 \times \left(\frac{3}{4}\right)^2 = \frac{8 \times 9}{27 \times 16}$$
$$= \frac{1}{6}$$

(ii) $\frac{(2ab)^3 (4a)^{-1}}{2b^2}$. (2 marks)

$$\frac{8a^3b^3}{2b^2 \times 4a} = a^2b$$

(b) Solve $\frac{2^2 \times (2^x)^x}{2^3} = 8$. (3 marks)

$$2^{x^2-1} = 2^3$$
$$x^2 = 4$$
$$x = \pm 2$$

Question 2 **(8 marks)**

(a) Factorise $x^2 - 7x - 44$. (1 mark)

$(x - 11)(x + 4)$

(b) Solve the following equations.

(i) $x^2 - 1 = 0$. (1 mark)

$x = -1,\ x = 1$

(ii) $2(x + 2)(4x - 3) = 0$. (2 marks)

$x = -2,\ x = \frac{3}{4}$

(c) The time, T in seconds, for a suitcase to travel along a particular conveyor belt is inversely proportional to the speed, S in metres per second, of the conveyor belt.

(i) Describe the effect on T if S is halved. (1 mark)

T is doubled.

(ii) Write an equation, using k as the constant of proportionality, to represent the relationship between T and S. (1 mark)

$TS = k$ or $T = \frac{k}{S}$

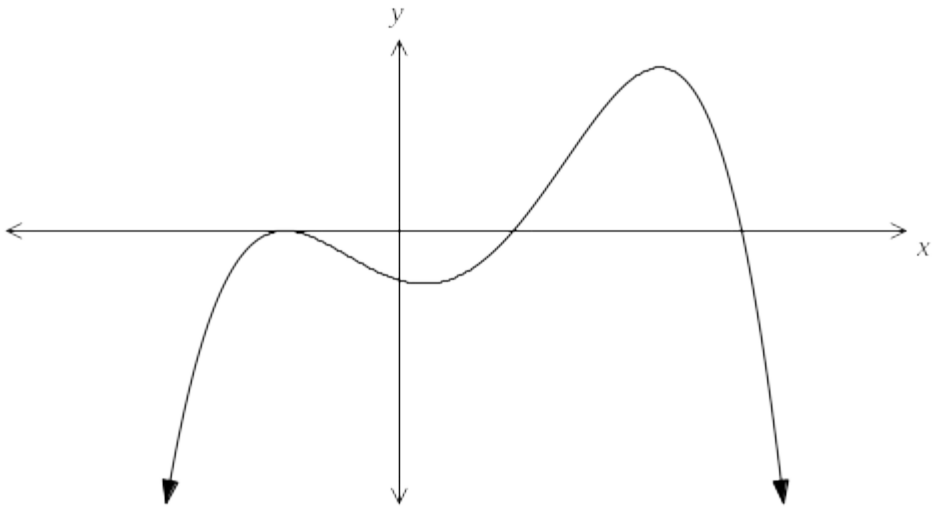
(iii) Given that $T = 8$ s when $S = 5$ m/s determine T when $S = 4$ m/s. (2 marks)

$k = 8 \times 5 = 40$

$T = \frac{40}{4} = 10$ s

Question 3 **(9 marks)**

The graph of the function $y=(3-x)(x-1)(x+1)^2$ is shown below.



(a) Determine the coordinates of the y-intercept. (2 marks)

$y=(3-0)(0-1)(0+1)^2=-3 \Rightarrow$ At $(0,-3)$

(b) For this function, state the number of

(i) stationary points. (1 mark)

3

(ii) local minima. (1 mark)

1

(iii) points of inflection. (1 mark)

2

(c) Circle all of the intervals below in which the graph is always concave down. (2 marks)

$-2<x<-1$ $-1<x<0$ $0<x<1$ $1<x<2$ $2<x<3$ $3<x<4$

(d) Calculate the global minimum for the function over the domain $-2 \le x \le 3$. (2 marks)

Must be when $x=-2$.

$(3-(-2))(-2-1)(-2+1)^2=-15$

Minimum value is -15.

See next page

Question 4 **(9 marks)**

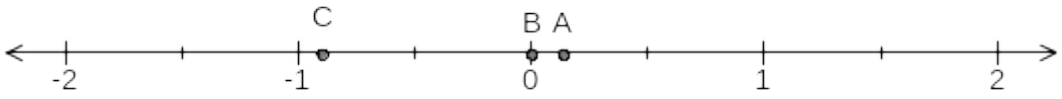
(a) A animal researcher described the association between several variables measured in an experiment using the following statements:

A. There was a weak positive association between exercise time and sleep time.

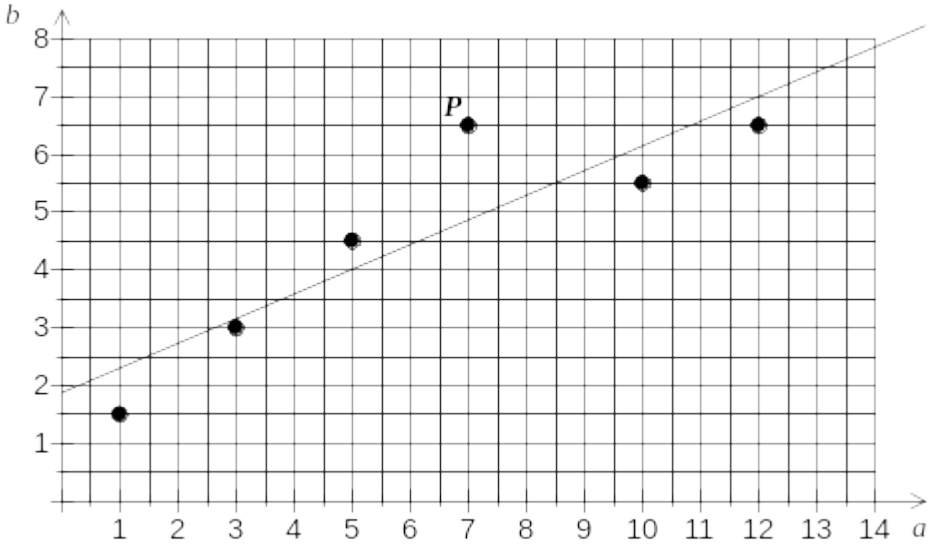
B. There was no association between weight of food consumed and exercise time.

C. There was a strong negative association between sleep time and task errors.

Mark each of these three expressions of association on the scale below, labelling each mark with its letter. (3 marks)



(b) The scatterplot and regression line for a set of bivariate data with correlation coefficient 0.9 is shown.



(i) Describe the effect on the correlation coefficient if the point labelled P was removed from the dataset. (1 mark)

Coefficient would increase.

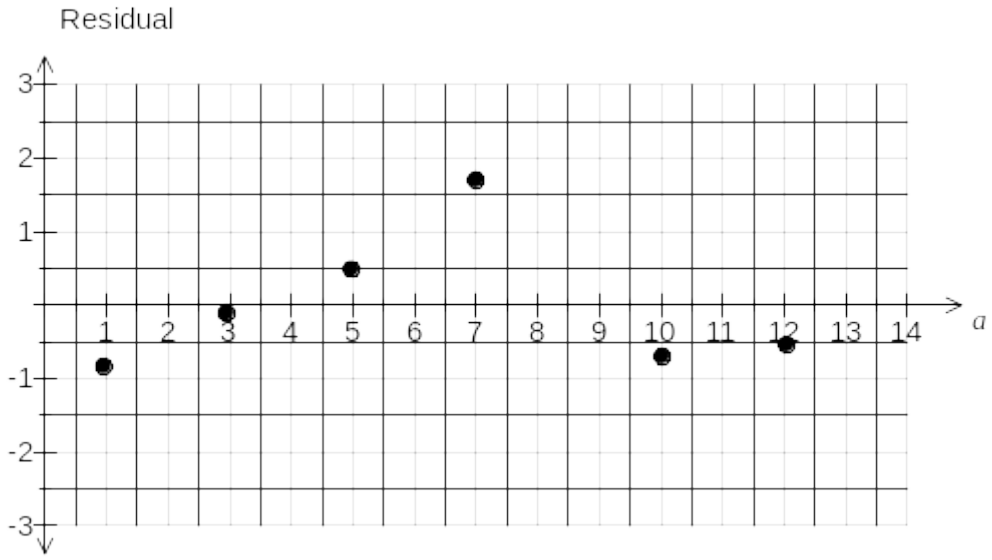
(ii) Describe the effect on the regression line if data points with $a > 8$ were cropped from the dataset. (2 marks)

- gradient would increase.

- b-intercept would decrease.

See next page

(iii) Construct a residual plot for the dataset on the axes below. (3 marks)



Question 5 **(9 marks)**

(a) Calculate the gradient of $y = 2x^3 - 4x^2 + 3x - 1$ at the point (2, 5). (2 marks)

$$\frac{dy}{dx} = 6x^2 - 8x + 3$$

$$= 6(2)^2 - 8(2) + 3$$
$$= 11$$

(b) Show use of the product rule to determine $\frac{d}{dx}\left((3x - 1)(1 - x^2)\right)$.

Give your answer in the form $ax^2 + bx + c$. (3 marks)

$$\frac{d}{dx}\left((3x - 1)(1 - x^2)\right) = 3(1 - x^2) + (3x - 1)(-2x)$$
$$= 3 - 3x^2 - 6x^2 + 2x$$
$$= -9x^2 + 2x + 3$$

(c) A function is given by $f(x) = ax^2 + bx - 3$. Given that $f(2) = 1$ and $f'(2) = 8$, write down two equations and solve them simultaneously to determine the values of a and b. (4 marks)

$$f(2) = 1 \Rightarrow 1 = 4a + 2b - 3$$

$$f'(x) = 2ax + b$$

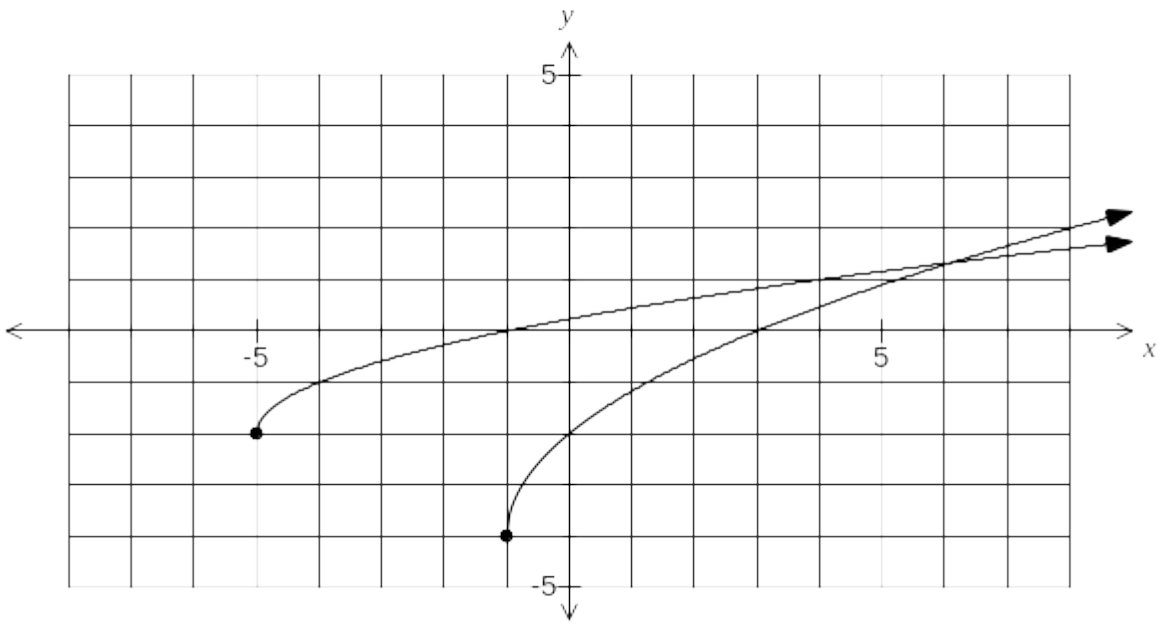
$$f'(2) = 8 \Rightarrow 8 = 4a + b$$

$$4a + 2b = 4$$
$$4a + b = 8$$
$$b = -4$$
$$a = 3$$

See next page

Question 6 **(8 marks)**

The function $y = f(x)$ is shown below.



(a) State the equation of $f(x)$ in the form $y = \sqrt{x + p} + q$, where the constants p and q are both integers. (2 marks)

$y = \sqrt{x + 5} - 2$

(b) State the domain and range of $f(x)$. (2 marks)

$x \geq -5$

$y \geq -2$

Another function is given by $g(x) = 2f(x - 4)$.

(c) Describe the transformations required to produce $g(x)$ from $f(x)$. (2 marks)

In either order:

- translation of 4 units in the positive x direction

- vertical dilation of scale factor 2

(d) Draw the graph of $y = g(x)$ on the axes above. (2 marks)

End of questions

Additional working space

Question number: _____

Additional working space

Question number: _____

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