

Question	Marks	Max	Question	Marks	Max
1	6	8	2	5	7
3	6	8	4	5	7
5	5	6	6	5	6
7	7	8	8	6	8
9	5	6	10	5	6

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Important note to candidates

Special items: nil

1.0 De provided By the candidate
Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Materials required/recommended for this section

Time allowed for this section	Reading time before commencing work	Working time:
five minutes	five minutes	fifteen minutes

— Your Teacher's Name —

Your Name _____

Calculator-free Section One:

UNIT 1

MATHEMATICS METHODS

Question/Answer booklet

Semester One Examination, 2020



INDEPENDENT PUBLIC SCHOOL

Excep~~tion~~al school~~s~~. Exceptio~~n~~al students.

CALCULATOR FREE 1 MATHEMATICS METHODS UNIT 1

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of examination
Section One: Calculator-free	8	8	50	50	33
Section Two: Calculator-assumed	13	13	100	100	67
Total					100

Instructions to candidates

1. The rules for the conduct of the Western Australian Certificate of Education ATAR course examinations are detailed in the *Year 12 Information Handbook 2020*. 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 answers to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Additional pages for the use of planning your answer to a question or continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number.
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.

Additional working space

Question number:

<p>Additional working space</p> <p>Question number:</p> <p>Section One: Calculator-free</p> <p>Section Two: Calculator-free</p> <p>Calculator Methods Unit 1</p> <p>MATHEMATICS METHODS UNIT 1</p> <p>Mathematics Methods Unit 1</p>	<p>Working time: 50 minutes.</p> <p>This section has eight (8) questions. Answer all questions. Write your answers in the spaces provided.</p> <p>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.</p> <ul style="list-style-type: none"> Planning: if you use the spare pages for planning, indicate this clearly at the top of the page. Continuing: if you need to use the spare pages to continue an answer, indicate this clearly at the top of the page. Original answer space: if you need to use the 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. <p>Solve the following equations.</p> <p>(a) $3 4x+8 =5(3-2x)$</p> <p>(b) $\frac{4}{x-1} - \frac{8}{2x+1} = x$</p> <p>(c) $-2x^2 + 8x = 1$ by using the quadratic formula</p> <p>(d) $x^2 - 6x + 6 = 0$ by completing the square</p>
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Solution	
$x = 3 \pm \sqrt{3}$	$(x-3)^2 - 3 = 0$
Specific behaviours	
$x = 2 \pm \frac{\sqrt{14}}{2}$	$x = \frac{8 \pm \sqrt{64-8}}{4}$
Solution	
$x = -\frac{8}{3}$	$2(x-1) - (2x+1) = 8x$
Specific behaviours	
$x = -\frac{8}{3}$	$2(x-1) - (2x+1) = 8x$
Solution	
$x = 2 \pm \frac{\sqrt{14}}{2}$	$x = \frac{8 \pm \sqrt{64-8}}{4}$
Specific behaviours	
$x = 3 \pm \sqrt{3}$	$(x-3)^2 - 3 = 0$
Solution	

Additional working space

Question number:

Section One: Calculator-free

Section Two: Calculator-free

Calculator Methods Unit 1

MATHEMATICS METHODS UNIT 1

Mathematics Methods Unit 1

This section has **eight (8)** questions. Answer all questions. Write your answers in the spaces provided.

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.

Working time: 50 minutes.

Planning: if you use the spare pages for planning, indicate this clearly at the top of the page.

Continuing: if you need to use the spare pages to continue an answer, indicate this clearly at the top of the page.

Original answer space: if you need to use the 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.

Question 2 {1.1.2, 1.1.11}**(8 marks)**

- (a) Point A is the intersection of lines $2x+y-4=0$ and $2y=-5x+11$. Point M (10,18) is the mid-point of Point A and Point B (a, b). Determine the values of a and b. (3 marks)

Solution
$\begin{cases} 2y = -4x + 8 \\ 2y = -5x + 11 \end{cases} \implies -4x + 8 = -5x + 11$ $x = 3 \wedge y = -2 \times 3 + 4 = -2$ $\therefore A(3, -2)$ $\frac{3+a}{2} = 10 \Rightarrow a = 17$ $\frac{-2+b}{2} = 18 \Rightarrow b = 38$
Specific behaviours
<input checked="" type="checkbox"/> determines coordinates for Point A <input checked="" type="checkbox"/> correct value for a <input checked="" type="checkbox"/> correct value for b

- (b) A parabola has x-axis intercepts (3, 0) and (-5, 0) and it passes through the point (4, 18). Find the turning point of this parabola. (2 marks)

Solution
$y = k(x-3)(x+5)$ $k(4-3)(4+5)=8 \implies k=2$ $\therefore y=2(x-3)(x+5)$ Line of symmetry $x = \frac{3+(-5)}{2} = -1$ $y = 2(-1-3)(-1+5) = -32$ Hence, turning point is (-1, -32)
Specific behaviours
<input checked="" type="checkbox"/> determines equation in factorised form <input checked="" type="checkbox"/> determines coordinates of turning point

- (c) A quadratic function has equation $y=3x^2+27x-108$. Find the coordinates of the x-intercepts. (2 marks)

Solution
$3x^2+27x-108=0$ $x^2+9x-36=0$ $(x-3)(x+12)=0$ Hence, x-intercepts are (3, 0) and (-12, 0)
Specific behaviours
<input checked="" type="checkbox"/> one correct x-intercept <input checked="" type="checkbox"/> two correct x-intercepts

- (d) Three quadratic functions $f(x)=9x^2-6x+1$, $g(x)=-x^2-5x-6$ and

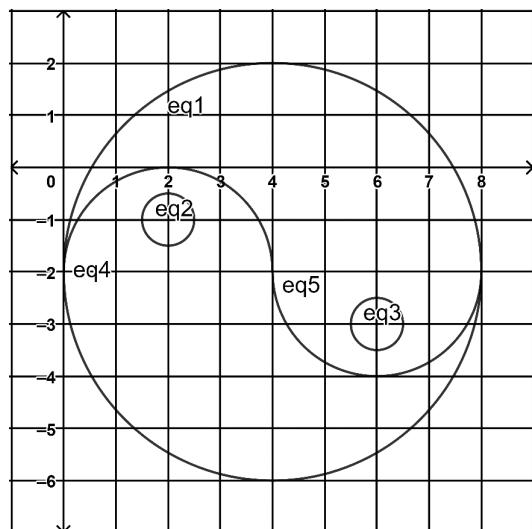
END OF SECTION ONE

Specific behaviours
✓ labels vertex (0,1)
✓ draws and labels axis of symmetry $y=1$
✓ parabolic shape with smooth curve

Question 4 {1.1.21, 1.1.28}

Consider the given graph below.

(7 marks)



(a) Determine the equations of all the curves forming the shapes in the graph.

(5 marks)

Solution
Eq1: $(x-4)^2 + (y+2)^2 = 16$
Eq2: $(x-2)^2 + (y+1)^2 = \frac{1}{4}$
Eq3: $(x-6)^2 + (y+3)^2 = \frac{1}{4}$
Eq4: $y = \sqrt{4-(x-2)^2} - 2$
Eq5: $y = -\sqrt{4-(x-6)^2} - 2$
Specific behaviours
✓ correct centre and radius for eq1
✓ correct centre and radius for eq2
✓ correct centre and radius for eq3
✓ correct eq4 (accept $(x-2)^2 + (y+2)^2 = 4$)
✓ correct eq5 (accept $(x-6)^2 + (y+2)^2 = 4$)

Question 7 {1.4.14}

(5 marks)

A and B are independent events. $P(A \cup B) = 0.64$ and $P(A|B) = 0.4$. Determine $P(B)$.

Solution
Let $P(B) = x$
Since A and B are independent event
$P(A) = P(A B) = 0.4$
$P(A \cap B) = P(A) \times P(B) = 0.4x$
Also, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$P = 0.4 + x - 0.4x$
$x - 0.24 = 0.4x$
$x = 0.4$
Hence, $P(B) = 0.4$
Specific behaviours
✓ states $P(A)$ is 0.4
✓ uses $P(A \cap B) = P(A) \times P(B)$
✓ uses $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
✓ forms an equation with $P(B)$
✓ correct number for $P(B)$

Solution
<p>eq4 & eq5. Use the vertical-line test: a vertical line can be drawn once, and thus shows two functions.</p> <p>that intersects with the graphs of the above equations no more than one, and thus shows two functions.</p>

(2 marks)

(b) List all the functions in the graph. Justify your answers.

Specific behaviours
<ul style="list-style-type: none"> ✓ lists the two functions ✓ states vertical-line test

(2 marks)

Shape
<ul style="list-style-type: none"> ✓ states the range ✓ plot or label points $(-6, 9)$ or $(2, 9)$

Question 5 {1.1.16, 1.1.17}

(5 marks)

- (a) Given that $-6x^3 - 13x^2 + 14x - 3 = (x+3)(bx^2 + cx - 1)$ for all values of x , for suitable values of b and c . Find b and c by equating coefficients.

(2 marks)

Solution

$$(x+3)(bx^2 + cx - 1)$$

$$\cancel{bx^3} + cx^2 - x + 3bx^2 + 3cx - 3$$

$$\cancel{bx^3} + (3b+c)x^2 + (3c-1)x - 3$$

$$\therefore b = -6$$

$$c = 5$$

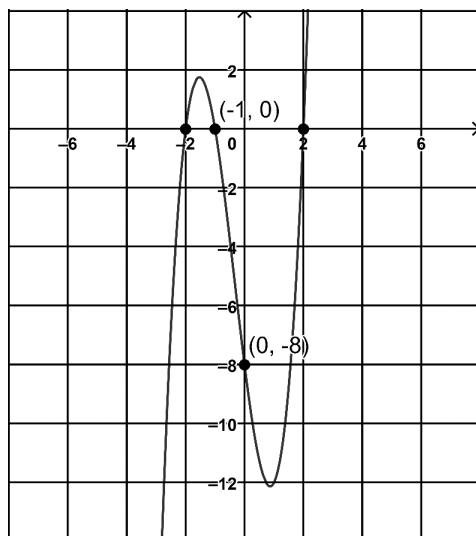
Specific behaviours

- ✓ correct value for b
- ✓ correct value for c

- (b) Consider the graph of polynomial $P(x)$ below. Determine the equation in the form

$$P(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$$

(3 marks)

**Solution**

$$P(x) = a_n(x-2)(x+1)(x+2)$$

$$P(0) = a_n(-2)(+1)(+2) = -8 \implies a_n = 2$$

$$P(x) = 2(x-2)(x+1)(x+2)$$

$$P(x) = 2x^3 + 2x^2 - 8x - 8$$

Specific behaviours

- ✓ determines coefficient a_n

Question 6 {1.1.24, 1.1.25}

(6 marks)

- (a) State the natural/implied domain and range for each of the relations/functions below.

(3 marks)

Relation/Function	Natural Domain	Natural Range
$y = \sqrt{x-3} + 5$	$[3, \infty)$	$[5, \infty)$
$y = \frac{4}{2x+3} - 5$	$\mathbb{R} / \{-\frac{3}{2}\}$	$\mathbb{R} / \{-5\}$
$(x+1)^2 + (y-2)^2 = 9$	$[-4, 2]$	$[-1, 5]$

Specific behaviours

- ✓ correct natural domain and natural range for $y = \sqrt{x-3} + 5$
- ✓ correct natural domain and natural range for $y = \frac{4}{2x+3} - 5$
- ✓ correct natural domain and natural range for $(x+1)^2 + (y-2)^2 = 9$

- (b) Sketch the graph of the function, $f: [-6, 2] \rightarrow \mathbb{R}$, $f(x) = \frac{1}{2}x^2 + 2x + 3$, and state its range.

(3 marks)

