Christ Church Grammar School

2019
TEST 1

MATHEMATICS METHODS Year 11
Section One:
Calculator-free

Your name Solutions & Marking Key

Teacher's name _____

Time and marks available for this section

Reading time for this section:	2 minutes
Working time for this section:	12 minutes
Marks available:	12 marks

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.

Instructions to candidates

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2. Write your answers in this Question/Answer Booklet.

3. Answer all questions.

4. 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.

5. Supplementary pages for the use of planning/continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

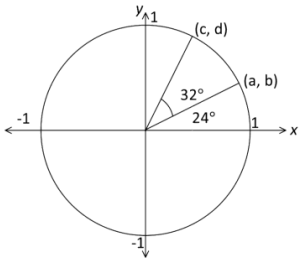
6. **Show all your working clearly**. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than 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.

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

See next page

Question 1 **(5 marks)**

Use the unit circle below to determine each of the following values in terms of a, b, c and/or d.



(a) cos 56° = c (1 mark)

✓ correct answer

(b) sin 156° = sin 24° (2 marks)

= b

✓ recognises $\sin 156° = \sin 24°$

✓ correct answer

(c) tan 336° = − tan 24° (2 marks)

$= -\frac{b}{a}$

✓ recognises $\tan 336° = -\tan 24°$

✓ correct answer

See next page

Question 2 **(4 marks)**

(a) Convert an angle of 135° to radian measure. Give your answer in simplified form. (1 mark)

$135 \times \frac{\pi}{180} = \frac{3\pi}{4}$

✓ correct answer

(b) Convert an angle of $\frac{7\pi}{6}$ radians to degrees. (1 mark)

$\frac{7\pi}{6} \times \frac{180}{\pi} = 210°$

✓ correct answer

(c) Evaluate $\sin 60^0 \times \tan 30^0$. (1 mark)

$= \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{3}}$

$= \frac{1}{2}$

✓ correct answer

(d) Evaluate $\cos\left(\frac{2\pi}{3}\right)$. (1 mark)

$= -\cos\left(\frac{\pi}{3}\right)$

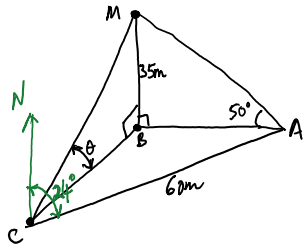
$= -\frac{1}{2}$

✓ correct answer

See next page

Question 9 **(5 marks)**

The top of a vertical radio mast stands 35 m above the surrounding level ground. From point *A* which is on the ground and due east of the base of the mast, the angle of elevation of the top of the mast is 50°. From another point on the ground, *C*, which is 60 m away from *A*, the bearing of the base of the mast is 024°. Calculate the angle of elevation of the top of the mast from point *C*.



$AB = \frac{35}{\tan 50°}$

$AB = 29.368$ m

$\therefore \quad 60^2 = BC^2 + 29.368^2 - 2(BC)(29.368)\cos 114°$

$\Rightarrow BC = 41.72 \text{ or } -65.61$ (ignore since $BC > 0$)

$\therefore \quad \tan\theta = \frac{35}{41.72}$

$\Rightarrow \quad \theta = 39.99°$

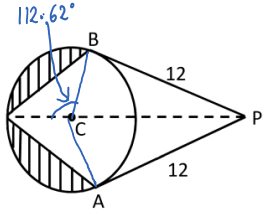
$\therefore$ Angle of elevation from C = $40°$

✓ correct diagram
✓ calculates distance AB
✓ uses cosine rule to set up an equation.
✓ solves for distance BC
✓ determines angle of elevation.

End of Questions

Question 8 Continued

(c) PC is extended to meet the circle again as shown below.
Find the area of the shaded region, rounded to 1 decimal place. (3 marks)



Area of one shaded segment $= \frac{112.62^\circ}{360^\circ} \times \pi \times 5^2 - \frac{1}{2} \times 5^2 \times \sin 112.62^\circ$

$= 13.03 \text{ cm}^2$

$\therefore$ shaded area $= 13.03 \times 2$

$\approx \underline{26.1 \text{ cm}^2}$ (1 dp)

✓ calculates area of sector and area of Δ
✓ calculates area of each segment
✓ determines the shaded area

See next page

Question 3 **(2 marks)**

A circular pizza is cut into 12 equal pieces.
If the arc length of each piece is 4 cm, then find the exact radius of the pizza.

$2\pi r = 4 \times 12$

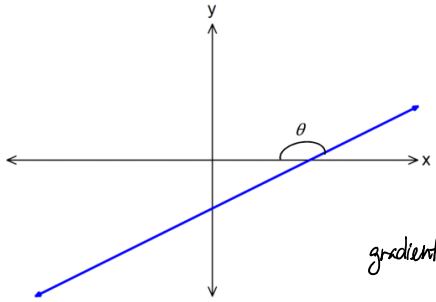
$\therefore r = \frac{48}{2\pi}$

$r = \underline{\underline{\frac{24}{\pi} \text{ cm}}}$

✓ uses an appropriate formula to set up an equation
✓ calculates a simplified value for radius.

Question 4 **(1 mark)**

Write down the value of the gradient of the straight line below, in terms of θ.



✓ correct answer

gradient $= -\tan(\theta)$
OR $\tan(180^\circ - \theta)$
OR $\tan(-\theta)$

End of questions

Christ Church Grammar School

2019
TEST 1

MATHEMATICS METHODS Year 11
Section Two:
Calculator-assumed

Your name Solutions & Marking Key

Teacher's name _____

Time and marks available for this section
Reading time for this section:	3 minutes
Working time for this section:	28 minutes
Marks available:	28 marks

Materials required/recommended for this section
To be provided by the supervisor
This Question/Answer Booklet
Formula Sheet (retained from Section One)

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

Special items: drawing instruments, templates, notes on one unfolded sheet of A4 paper and up to three calculators approved for use in the WACE examinations

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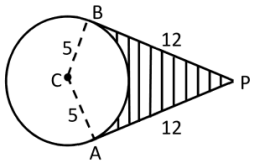
Question 8 **(8 marks)**

AP and BP, each of length 12 cm, are tangents to the circle centred at C whose radius is 5 cm as shown below.

Note: Tangent BP is perpendicular to radius BC.



✓uses a trigonometric ratio to calculate ∠BCP

✓calculates ∠BCA

(a) Show that ∠BCA = 134.8°, rounded to 1 decimal place. (2 marks)

$\tan \angle BCP = \frac{12}{5}$

$\therefore \angle BCP = 67.38°$

$\Rightarrow \angle BCA = 67.38 \times 2$ (since $\Delta BCP \equiv \Delta ACP$)

$= 134.8°$ (1dp)

(b) Find the area of the shaded region, rounded to 1 decimal place. (3 marks)

Area of quadrilateral BPAC $= 2 \times \frac{1}{2} \times 12 \times 5$

$= 60 \text{ cm}^2$

Area of sector BCA $= \frac{134.8}{360} \times \pi \times 5^2$

$= 29.4 \text{ cm}^2$

$\therefore$ shaded area $= 60 - 29.4$

$= 30.6 \text{ cm}^2$ (1 dp)

✓calculates area of quadrilateral

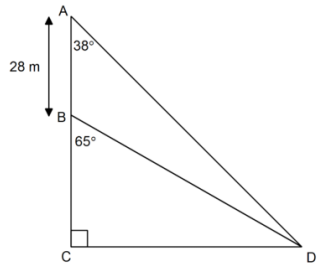
✓calculates area of sector

✓determines shaded area

See next page

Question 7 **(4 marks)**

Consider the diagram below:



Find to the nearest metre:

(a) length BD. (2 marks)

$\frac{BD}{\sin 38°} = \frac{28}{\sin 27°}$

$\therefore BD = \frac{28 \sin 38°}{\sin 27°}$

$= 38 \text{ m}$ (nearest m)

✓ uses sine rule correctly
✓ calculates length BD

(b) length CD. (2 marks)

$\sin 65° = \frac{CD}{BD}$

$\therefore CD = BD \sin 65°$

$= 34 \text{ m}$ (nearest m)

✓ uses an appropriate trigonometric ratio
✓ calculates length CD

See next page

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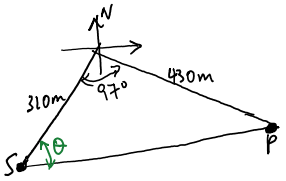
See next page

Question 5 **(6 marks)**

Peter and Stephen are sea-kayaking. From a buoy, Peter is 430 m away on a bearing of 113°. Stephen is 310 m from the buoy on a bearing of 210°.

(a) What is the direct distance between Peter and Stephen? (3 marks)



$SP^2 = 310^2 + 430^2 - 2(310)(430)\cos 97°$

$\therefore SP = 559.90 \text{ m}$ (2dp)

✓ correct diagram
✓ correct use of cosine rule
✓ calculates distance correctly

(b) What is the bearing of Peter from Stephen? (3 marks)

$$\cos\theta = \frac{310^2 + 559.90^2 - 430^2}{2(310)(559.90)}$$

$\therefore \theta = 49.66°$

$\Rightarrow$ Bearing of Peter from Stephen $= 079.66°$

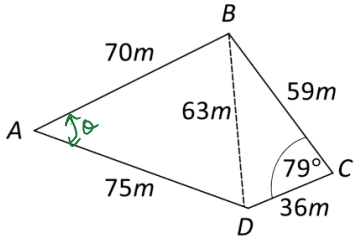
$\approx 080°\text{T}$

✓ correct use of either sine or cosine rule
✓ calculates the value of θ
✓ calculates the bearing of P from S

See next page

Question 6 **(5 marks)**

Bill and Malcolm buy a plot of land. The sales agent provides a drawing of the plot of land, showing the following measurements:



Calculate the area of the whole plot of land to the nearest m^2.

Area of $\Delta BCD = \frac{1}{2}(59)(36)\sin 79°$

$= 1042.488 \text{ m}^2$

In ΔABD, $\cos\theta = \frac{70^2 + 75^2 - 63^2}{2(70)(75)}$

$\therefore \theta = 51.363°$

$\therefore$ Area of $\Delta ABD = \frac{1}{2}(70)(75)\sin 51.363°$

$= 2050.44 \text{ m}^2$

$\therefore$ Area of plot of land $= 1042.488 + 2050.44$

$= 3092.93 \text{ m}^2$

$\approx 3093 \text{ m}^2$ (nearest m^2)

✓ calculates area of ΔBCD
✓ uses cosine rule correctly
✓ calculates value of θ in ΔABD
✓ calculates area of ΔABD
✓ calculates total area

See next page