YEAR 11 MATHEMATICS
METHODS UNIT 1

TEST 1
TERM 1, 2021
Test date: Wednesday 4th March

APPLECROSS
SENIOR HIGH SCHOOL

STUDENT NAME: Solutions

All working must be shown in the space provided. 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 2 marks, valid working or justification is required to receive full marks.

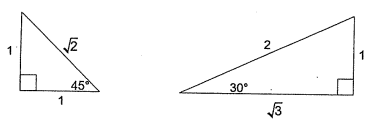
	Total	Result	
Section 1	17		%
Section 2	33		
Total	50		

Section 1: Resource – Free

Working time: 20 minutes

Question 1 **[1, 2, 2, 2 = 7 marks]**

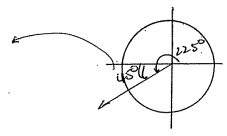
Consider the two right triangles shown below.



Use the triangles above and reference angles to determine the **exact** value of

(a) $\cos 60° = \frac{1}{2}$ ✓

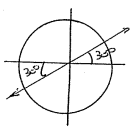
(b) $\sin 225° = -\sin 45° = -\frac{1}{\sqrt{2}}$ ✓ ✓



(c) θ, where $\tan\theta = \frac{1}{\sqrt{3}}$ for $0 \le \theta \le 360°$

reference angle = 30°

$\theta = 30°$ or $210°$ ✓ ✓



(d) Use the triangle from page 1 (showing an angle of 30°) to demonstrate that $\frac{\sin\theta}{\cos\theta} = \tan\theta$

$\sin 30° = \frac{1}{2}$

$\cos 30° = \frac{\sqrt{3}}{2}$ ✓

$\tan 30° = \frac{1}{\sqrt{3}}$

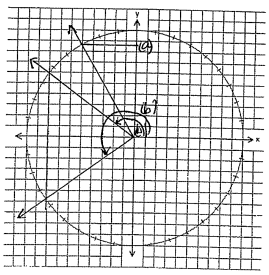
$\frac{\sin 30°}{\cos 30°} = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} = \frac{1}{\sqrt{3}}$ ✓

$\therefore \tan 30° = \frac{\sin 30°}{\cos 30°}$

Question 2 **[1, 2 = 3 marks]**

Use the unit circle below to answer the questions on the right.

Give your answers to an appropriate degree of accuracy.



(a) Determine the value of sin 120°

~ 0.87 (± 0.02) ✓

(b) Solve for x where $\cos x = -0.8$ *and* $0° \le x \le 360°$

$x = 143.1°$ or $216.9°$ ✓ ✓

accept 142–144, 216–218

Question 3 [2 marks]

(a) Convert $\frac{5\pi}{6}$ radians to degrees

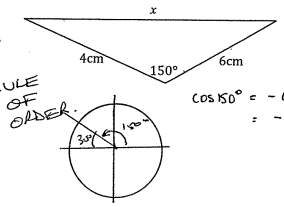
$\frac{5\pi}{6} \times \frac{180}{\pi} = 150°$ ✓

(b) Express $-285°$ to radians, as a fraction of π.

$-285 \times \frac{\pi}{180} = \frac{-285\pi}{180}$ (reduces to $\frac{-19\pi}{12}$) ✓

Question 4 [3, 2 = 5 marks]

(a) Find the exact value of x showing full and correct setting out.



$x^2 = 4^2 + 6^2 - 2 \times 4 \times 6 \times \cos 150°$ ✓

$= 16 + 36 - 48 \times -\frac{\sqrt{3}}{2}$ ✓

$= 52 + 24\sqrt{3}$ ✓ RULE OF ODDER.

$\cos 150° = -\cos 30°$

$= -\frac{\sqrt{3}}{2}$ ✓

(b) Calculate the area of the triangle.

$\sin 150° = \sin 30° = \frac{1}{2}$

$A = \frac{1}{2} \times 4 \times 6 \times \sin 150°$ ✓

$= \frac{1}{2} \times 4 \times 6 \times \frac{1}{2}$

$A = 6 \text{ cm}^2$ ✓

End of Section 1

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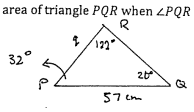
	Total	Result	
Section 1	17		%
Section 2	33		
Total	50		

Section 2: Resource – Rich

Working time: 35 minutes

Question 1 [8 marks]

(a) Determine the area of triangle PQR when $\angle PQR = 26°$, $\angle PRQ = 122°$ and $PQ = 57$ cm. (4 marks)



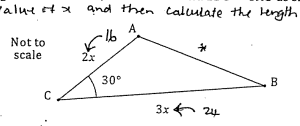
$\frac{q}{\sin 26°} = \frac{57}{\sin 122°}$ ✓ ↓ CASSPAD

$q = 29.46$ cm ✓

$A = \frac{1}{2} \times 57 \times 29.46 \times \sin 32°$ ✓ ↓ CASSPAD

$= 445 \text{ cm}^2$ ✓

(b) The area of triangle ABC is 96 cm^2, $\angle ACB = 30°$ and $2BC = 3AC$ as shown in the diagram. Determine the value of x and then calculate the length of AB. (4 marks)



$96 = \frac{1}{2} \times 2x \times 3x \times \sin 30°$ ✓ ↓ CASSPAD

$x = 8$ ✓

$AB^2 = 16^2 + 24^2 - 2 \times 16 \times 24 \times \cos 30°$ ✓ ↓ CASSPAD

$AB = 12.92$ cm ✓

Question 2 [2, 3 = 5 marks]

(a) A segment of a circle of radius 22 cm is shown below, where $\theta = 126°$.

Determine the area of the segment. (2 marks)

$A = \frac{1}{2} \times 22^2 \left(\frac{7\pi}{10} - \sin \frac{7\pi}{10} \right)$ ✓

$A \approx 336.4 \text{ cm}^2$ ✓

(336 ✓)

(b) Determine the perimeter of the segment. (3 marks)

arc length: $\ell = r\theta$

$= 22 \times \frac{7\pi}{10}$

$\ell = 48.4$ cm ✓

chord: $22^2 + 22^2 - 2 \times 22 \times 22 \times \cos 126°$

$= 39.2$ cm ✓

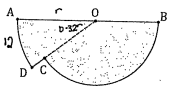
$P = 48.4 + 39.2$

$P = 87.6$ cm ✓

ONCE AGAIN USE CLASSPAD TO "SOLVE" THE EQUATIONS

Question 3 [5 marks]

Shape $AOBCDA$ below consists of sector BOC of circle centre O joined to sector DOA of a different circle, also centre O. AB is a line of length 65 cm, arc AD is 12 cm long and $\angle AOD = 0.32$ radians.



(a) Determine the length OA. (2 marks)

arc length $= r\theta$

$12 = r \times 0.32$ ✓

$r = 37.5$ cm ✓

(b) Determine the area of the shape. (3 marks)

DOA : $A = \frac{1}{2} r^2 \theta = \frac{1}{2} \times 37.5^2 \times 0.32$

$= 225$ ✓

OB : $65 - 37.5 = 27.5$

BOC : $A = \frac{1}{2} \times 27.5 \times (37.5 - 0.32) = 1067$ ✓ CLASSPAD

$\therefore A = 225 + 1067 = 1292 \text{ cm}^2$ ✓

Question 4 [3 marks]

Calculate, to the nearest degree, the acute angle between the line $y = 1.5x - 4$ and the line $y = -0.5x + 4$.

$y = 1.5x - 4$ $\quad m_1 = 1.5 = \tan\theta_1$

$\theta_1 = 56.31°$ ✓

$y = -0.5x + 4$ $\quad m_2 = -0.5 = \tan\theta_2$

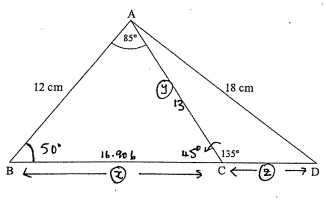
$\theta_2 = -26.57°$ ✓

angle $= 56.31 + 26.57$

$= 83°$ ✓

Question 5 [6 marks]

Determine, correct to 2 decimal places, the length of side BD in the diagram below.



Note: the diagram is not drawn to scale.

x : $\frac{x}{\sin 85^\circ} = \frac{12}{\sin 45^\circ}$ ✓

$x = 16.90608$ ✓

AC : $\frac{y}{\sin 30^\circ} = \frac{12}{\sin 45^\circ}$ ✓

$y = 13$ ✓

* SEE COMMENTS IN SEPARATE SHEET.

CD : $18^2 = 13^2 + z^2 - 2 \times 13 \times z \times \cos 135^\circ$

$z = 6.28314$ ✓

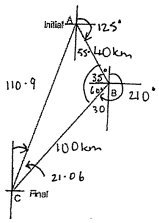
BD = $16.906 + 6.28314$

(2dp) $= 23.19$ cm ✓

Question 6 [1, 2, 3 = 6 marks]

A boat sails from A in the direction 125° for 40 km. It then sails along 210° for 100 km.

(a) Complete the diagram below to show this information. (1 mark)



✓

(b) Calculate the direct distance between A and its final position. (2 marks)

$\angle ABC = 95^\circ$

$AC^2 = 40^2 + 100^2 - 2 \times 40 \times 100 \times \cos 95^\circ$ ✓

$AC = 110.9$ km ✓ CLASSPAD

(c) Find the bearing of A from its final position. (3 marks)

$\frac{\sin C}{40} = \frac{\sin 95^\circ}{110.9}$ ✓

$C = 21.06^\circ$ ✓

bearing $= 90 - (21.06 + 60)$ (or $30 - 21.06$)

$= 8.94^\circ$ ✓

End of Section 2

Comments Regarding Test 1

Section 1

Question1

(a) Well done.

(b) A number of students didn't find the reference angle or failed to recognise that the angle was in the third quadrant so that the value was negative.

(c) Most were able to find the acute angle (30^0) but forgot the 210^0 solution.
Draw a sketch of the unit circle.

(d) Most attempted the question but the setting out was generally poor.

Question 2

(a) Many didn't use the unit circle and gave the exact value whilst others didn't attempt it.

(b) Many didn't use the unit circle. Few were able to obtain the correct answers.

Question 3

This question was answered correctly by most students. Some made careless errors.

Question 4

(a) A number of students wrote down ***sin*** instead of ***cos*** in the formula.
Also, some added the 52 and 24 together to get 76 first (28 if they subtracted) to give an answer of $76\sqrt{3}$.(b)

(b) Most were able to obtain the correct answer to this question.

Section 2

Remember that you should make use of the ClassPad wherever possible to solve equations rather than putting in 3 or 4 lines of working- ***write down the equation then solve it on the ClassPad (2 lines of "working").***

Question 1

(a) Generally well done but many rearranged the equation before solving it- not necessary.

(b) Students were either able to find the answer or couldn't make a start.

Question 2

(a) Check that calculator is set to radians.

(b) A number of students didn't realise that the perimeter was made up of the arc length and the length of the Chord.

Question 3

(a) Done easily by most students.

(b) Poorly done.

Question 4

Poorly done- see solutions.

Question 5

Many students used variables in their calculations but did not label the diagram with them.
Reasonably done well by most students.
BC and CD answers should be given to 4 decimal places as their values will be used in a further calculation.

Question 6

(a) Some had difficulty in labelling the diagram correctly which caused issues in the calculations.
Check the solutions carefully to ensure that you understand how the numbers are placed.

(b) Full marks were given if angle B on their diagram was used correctly in this part.

(c) Very few were able to find the bearing of A FROM C. Could be due to running out of time as this is the last question on the paper.