Marking Scheme

College ABCD

Topic Test

Assessment Period:	**2022 S2**
Course:	**MATHEMATICAL APPLICATIONS**
Unit:	**Unit 2: Mathematical Applications (1.0)**
Accreditation:	**T**
Weight:	**30%**
Maximum Mark:	**36**
Due Date:	**20 Oct**

Assessment Conditions

- Test completed in-class – no collaboration
- One A4, single sided, handwritten page of notes allowed
- Scientific Calculators permitted

Additional Information

Time allowed: 50 minutes

Other Applicable Policies

Academic Integrity

The BSSS and College ABCD is committed to a system of school-based assessment and views seriously any breach of the rules or instructions governing assessment. Any cheating, plagiarism, dishonesty, alteration of results or improper practice in relation to school-based assessment in any subject shall constitute a breach of discipline. This includes any tampering with the assessment data on computer files by a student.

Any work that is found to be in breach of discipline in in relation to school-based assessment will incur a penalty ranging from a reprimand and warning, in writing, through to the cancellation of all assessment results for Years 11 and 12. Students who unintentionally breach the rules of school-based assessment will be given appropriate counselling and guidance so they do not repeat the offence. The impact on unit scores of the penalties imposed for serious and repeated instances will be managed in accordance with the BSSS Policy and Procedures . Any offence will be reported to the Faculty Leader who will then inform the Teaching and Learning Coordinator for escalation to the Assistant Principal where necessary.

Students are to refer to and be familiar with the BSSS Academic Integrity: Student Guide to ensure student obligations and academic integrity are met. A College Referencing and Curriculum Guide is accessible via the student handbook.

The College uses Turnitin to assist students to prevent plagiarism and enhance academic skills for original thinking, authentic writing, proper attribution and academic integrity practices. Students are to use this tool to check text similarity, find missing citations and ensure proper citation using the Harvard Referencing Style for all assessment from first draft to final submission. The use of Turnitin does not apply to exams and in-class tests.

When submitting the task, students are to sign off on the below prompt made visible via the LMS:

I certify that:

(a) The work that I have submitted is my own work and has not been submitted for assessment before.

(b) I have kept a copy of this assignment and all relevant notes and references materials that I used in the production of the assignment.

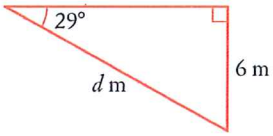
(c) I have given references for all sources of information that are not my own, including the words, ideas and images of others.

For academic integrity
Review BSSS Policy and Procedure Manual 4.3.12 for more details.

Part A: Multiple-choice Section

Each question is worth 1 mark.

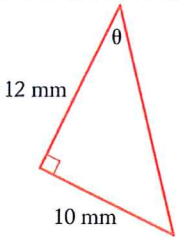
1 The length of d in the triangle below is closest to:



$\sin 29 = \frac{6}{d}$

6.86 m	10.82 m	12.38 m	2.90 m	6.00 m

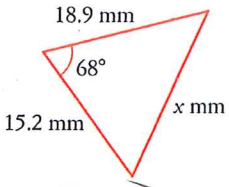
2 The magnitude of θ in the triangle below is closest to:



$\tan\theta = \frac{10}{12}$

40°	56°	34°	39°	16°

3 The perimeter of the triangle below is:



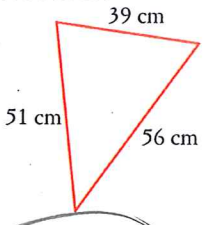
$x^2 = 18.9^2 + 15.2^2 - 2 \times 18.9 \times 15.2 \times \cos 68$

$x = 19.3$

$P = 53.4$

19.3 mm	38.1 mm	53.4 mm	410 mm	58.4 mm

4 The area of the following triangle is closest to:



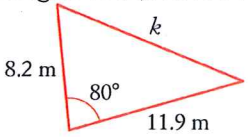
$s = 73$

$A = \sqrt{73(73-39)(73-51)(73-56)}$

$A = 963.5$

994.5 cm^2	1092 cm^2	963.5 cm^2	112.8 cm^2	11557.2 cm^2

5 Which expression will give you the length of k (in metres) in the following triangle?



$k^2 = 8.2^2 + 11.9^2 - 2 \times 8.2 \times 11.9 \times \cos(80)$

$k = \sqrt{\quad}$

$\sqrt{8.2 \times 11.9 - 2 \times 8.2 \times 11.9 \cos(80°)}$	$\frac{11.9 \sin(80°)}{8.2}$
$8.2^2 + 11.9^2 - 2 \times 8.2 \times 11.9 \cos(80°)$	$\sqrt{8.2^2 + 11.9^2 - 2 \times 8.2 \times 11.9 \cos(80°)}$
$\frac{8.2 \sin(80°)}{11.9}$	

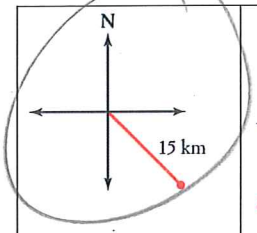
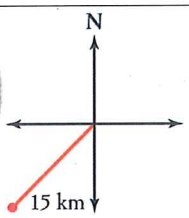
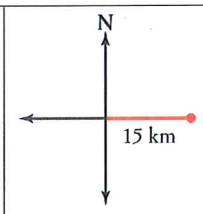
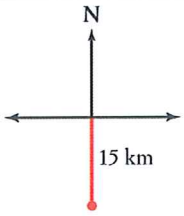
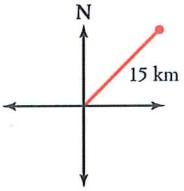
6 An equilateral triangle has side lengths of 10 cm. Which of the following is not equal to the height of the triangle?

$\frac{5}{\tan(30°)}$	$5\cos(30°)$	$\sqrt{10^2 - 5^2}$	$10\sin(60°)$	$10\cos(30°)$

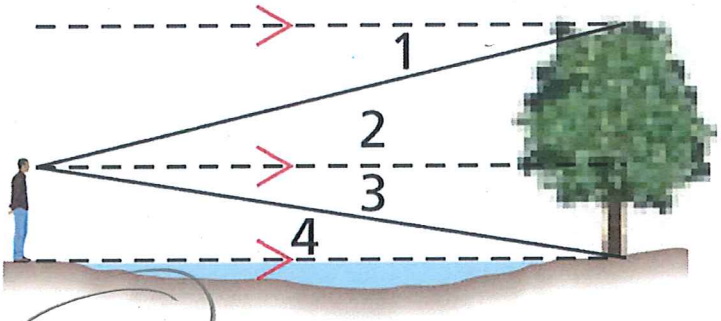
7 The true bearing 280° is equal to:

N280°W	N10°W	W10°N	W80°N	N80°W

8 Michelle sailed 15 km in a south-easterly direction. Which of the following diagrams illustrates her journey?

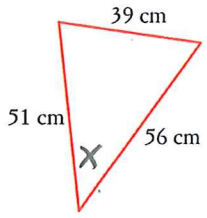
				

9 In the diagram below, decide which angle would represent the angle of depression for a butterfly sitting in the tree looking at the man.



Angle 1	Angle 2	Angle 3	Angle 4

10 Find the size of the smallest angle in the triangle below.



76°	42°	62°	48°	36°

$\cos X = \frac{51^2 + 56^2 - 39^2}{2 \times 51 \times 56}$

$x = 42.4°$

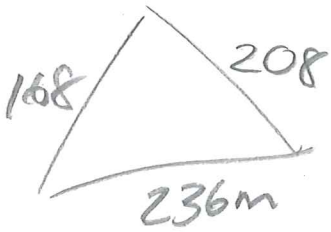
Short Response Questions

1 Farmer Jo has a triangular dam on her property. The lengths of the sides are 168m, 208m and 236m. Calculate the area of the dam, to the nearest square metre. **[3 Marks]**

$S = 612 \div 2 = 306$

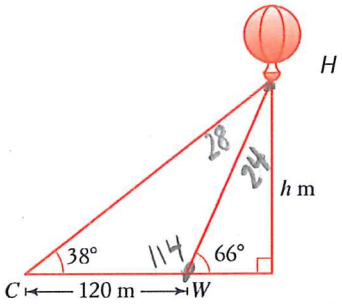
$A = \sqrt{306(306-236)(306-208)(306-168)}$

$= 17020\ m^2$ (2) answer



(1) diagram

2 William (W) and Chris (C), standing 120 m apart, observe a hot air balloon (H) at angles of elevation of 66° and 38° respectively. **[2+1=3 Marks]**



a Find the distance between William and the hot air balloon correct to two decimal places.

$\frac{WH}{\sin 38} = \frac{120}{\sin 28}$

$WH = \frac{120 \sin 38}{\sin 28}$

$WH = 157.37$ (1)

Distance = 157.37m between William & hotair balloon (1)

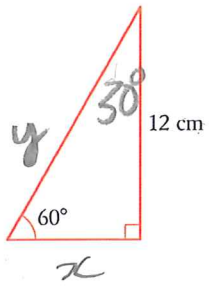
b Calculate the height of the hot air balloon, h metres, correct to two decimal places.

$\sin 66 = \frac{h}{157.37}$

$h = 143.76$

height of balloon is 143.76m (1)

3 Calculate the area of this triangle using two different methods. Answer correct to two decimal places. **[3 Marks]**



Method 1

Find x

$\tan 60 = \frac{12}{x}$

$x = \frac{12}{\tan 60}$

$x = 6.93$ cm (1)

height = 12

base = 6.93

$A = \frac{1}{2} \times 6.93 \times 12$

$A = 41.58 cm^2$

$\frac{1}{2}$

Method 2

Find y

$\sin 60 = \frac{12}{y}$

$y = \frac{12}{\sin 60}$

$y = 13.86$

Area $= \frac{1}{2} \times a \times b \times \sin C$

$a = 13.86, b = 12, C = 30°$

$A = \frac{1}{2} \times 13.86 \times 12 \times \sin 30$

$A = 41.58 cm^2$ $1\frac{1}{2}$

Part C: Analysis questions

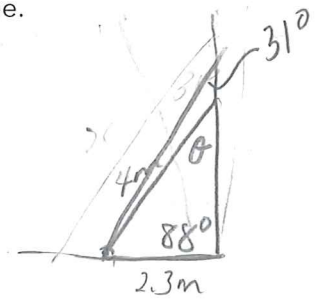
1 A wall leans inwards and makes an angle of 88° with the floor. **[2+2+3=7 Marks]**

a A 4 m long ladder leans against the wall with its base 2.3 m out from the wall. Find the angle that the top of the ladder makes with the wall, to the nearest degree.

$\frac{\sin\theta}{2.3} = \frac{\sin 88}{4}$

$\sin\theta = \frac{2.3 \times \sin 88}{4}$

$\sin^{-1}\left(\frac{2.3 \times \sin 88}{4}\right) = \theta$



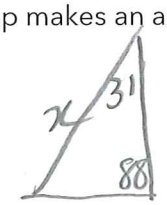
(1) answer

$\theta = 35°$

(1) diagram

b A longer ladder is placed the same distance out from the wall and its top makes an angle of 31° with the wall.

i How long is this ladder (correct to two decimal places)?



(1) diagram

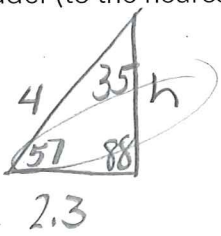
$\frac{x}{\sin 88} = \frac{2.3}{\sin 31}$

$x = \frac{2.3 \sin 88}{\sin 31}$

$x = 4.46\text{m}$

(1) answer

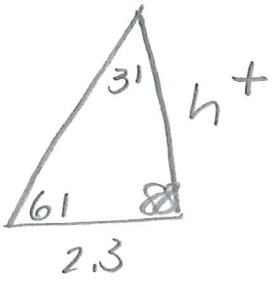
ii How much further does it reach up the wall than the first ladder (to the nearest centimetre)?



$\frac{\sin 57}{h} = \frac{\sin 35}{2.3}$ (1)

$h = \frac{2.3 \sin 57}{\sin 35}$

$h = 3.363\text{m}$



$\frac{\sin 61}{h^+} = \frac{\sin 31}{2.3}$

$h^+ = \frac{2.3 \sin 61}{\sin 31}$ (1)

$h^+ = 3.906\text{m}$

difference =

$3.906 - 3.363$

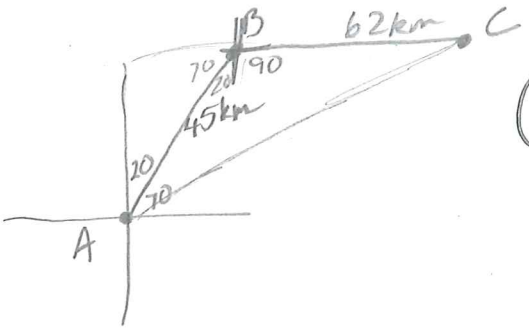
0.543m further up the wall

54cm further up the wall.

(1)

2 A helicopter is delivering supplies to three islands off the coast.
The helicopter leaves island A on a bearing of 020°T and flies for 45km to reach island B. It then heads due east to reach island C, which is 62km away. **[2+2=4 Marks]**

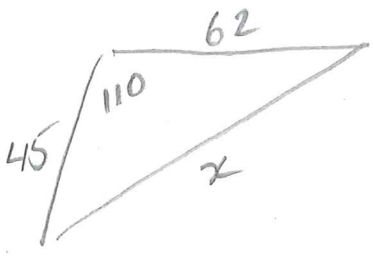
a Draw a diagram to represent islands A, B and C (not to scale), with noted dimensions.



(2) $\angle B = 110$

Label sides AB
BC
one of the angles at
(A)
20 or 70

b Calculate the distance between island C and island A, correct to two decimal places.



$x^2 = 62^2 + 45^2 - 2 \times 62 \times 45 \times \cos(110)$

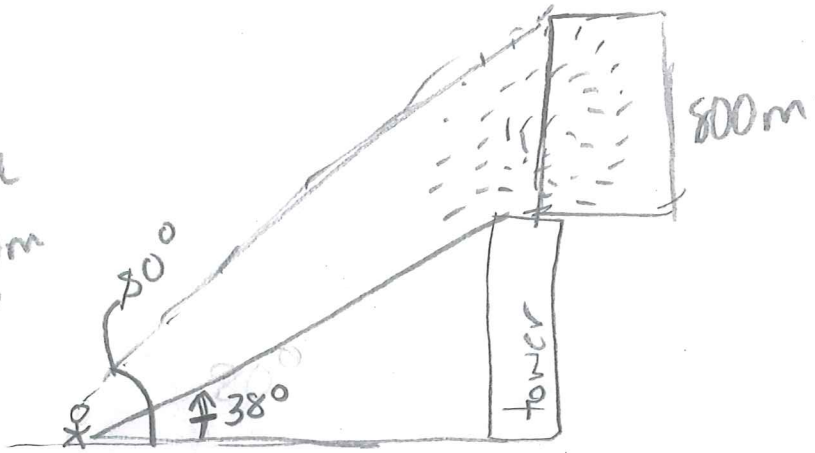
$x = 88.54\text{km}$ (2)

3 31-year-old Larry stands on the ground and sees the Canberra fireworks that are launched from the top of a tower at 9:15pm on 31st December, 2020. Larry sees the top of the tower at an angle of elevation of 38^0. Larry estimates there are 1500 people standing around the tower. When the fireworks are at their highest point, they are 800m above the tower and Larry sees them at an angle of elevation of 80^0. After the fireworks at completed at 9:42pm, Larry walks 1.6km back to where his car is parked and then drives home, 11.8 km away. He returns home at 10:30pm.

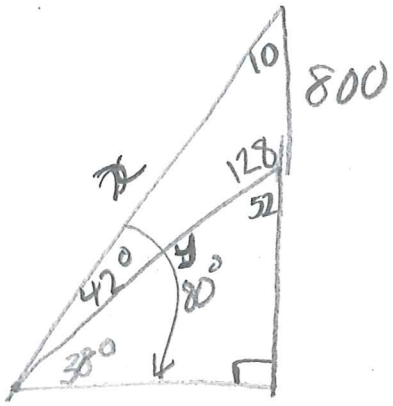
[2+2+2=6 marks]

a Determine the relevant information and sketch a diagram that allows you to find the distance between Larry and the highest point of the fireworks. Label all measurements relevant to finding this distance.

(2)
(½) needs to draw correctly label
(½) 800m
(½) 80°
(½) 38°



b Determine the distance between Larry and the highest point of the fireworks, to the nearest metre.



$$\frac{\sin 42}{800} = \frac{\sin 128}{x} \quad (1)$$

$$x \sin 42 = 800 \sin 128$$

$$x = \frac{800 \sin 128}{\sin 42}$$

$$x = 942.13 \quad (1)$$

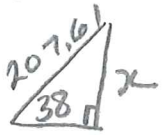
The distance between Larry and the top of the fireworks is 942m

c Calculate the height of the fireworks above the ground, to the nearest metre.

$$\frac{\sin 42}{800} = \frac{\sin 10}{y}$$

$$y = \frac{800 \sin 10}{\sin 42}$$

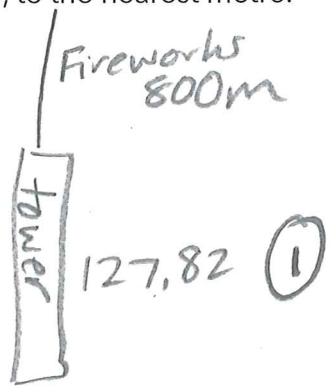
$$y = 207.61$$



$$\sin 38 = \frac{x}{207.61}$$

$$207.61 \times \sin 38 = x$$

$$127.82 = x$$



(1)

The height of the fireworks above the ground is 928m. (1)

4 Murray is completing some yard work and has made the following sketch. He needs to work out the size of each angle to cut the lengths of timber required for the garden bed. He has worked out the angles below. However, he ends up with a triangle that totals to only 113.7 degrees and knows there is an error somewhere but is unsure where the error lies. **[1+2+2=5 marks]**

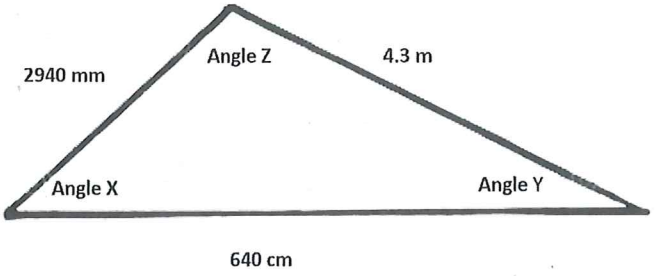


Image is not drawn to scale

To find Angle Z:

$$\cos(Z) = \left(\frac{2.94^2 + 6.4^2 - 4.3^2}{2 \times 2.94 \times 6.4}\right)$$

$$Angle\ Z = 34.23°$$

To find Angle Y:

$$\frac{\sin Y}{2.94} = \frac{\sin(34.23)}{4.3}$$

$$\sin(Y) = \frac{2.94 \times \sin(34.23)}{4.3}$$

$$Angle\ Y = 22.62°$$

To find Angle X:

$$\frac{\sin(X)}{6.4} = \frac{\sin(34.23)}{4.3}$$

$$\sin(X) = \frac{6.4 \times \sin(34.23)}{4.3}$$

$$Angle\ X = 56.85°$$

a Identify where Murray has made his error. In his calculations for angle X, Y or Z?

(1) Angle X

b Determine what the correct angle should be.

(b) Angle X = 56.85°
This is an example of the Ambiguous Case

c Explain where Murray went wrong in his calculations.

(c) (1) Ambiguous Case - need to use supplementary angle (1)

(1)
The angle found 56.85° is the supplementary angle to Angle X

(1)
Angle X = 180 − 56.85 = 123.15°

Checking Angle Sum 34.23 + 22.62 + 56.85 = 180°