

MATHEMATICS APPLICATIONS

YEAR 11 UNIT 2

TEST 5

2022



SECTION ONE – CALCULATOR FREE

TIME: 20 mins

MARKS: /28 marks

(-1) units

STUDENT'S NAME: Solutions

CIRCLE YOUR TEACHER'S NAME:

Dr Duan

Mr Riemer

Mr Stillitano

Mr Galbraith

Miss Colquhoun

Ms Regi

No calculators or Classpads are allowed during this section of the test.
Show all necessary working in order to obtain full marks.
Formula sheet provided.

The following information is provided for section one:

$$\sin(30^\circ) = 0.5$$

$$\cos(60^\circ) = 0.5$$

$$\tan(45^\circ) = 1$$

$$\sin(150^\circ) = 0.5$$

$$\sin(90^\circ) = 1$$

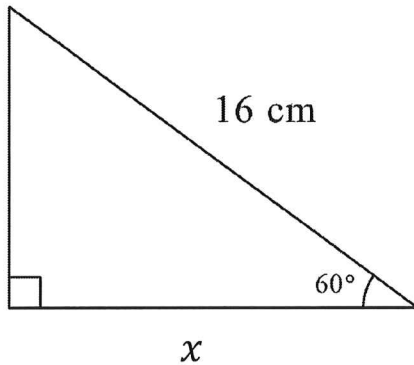
$$\cos(90^\circ) = 0$$

Question 1

[2, 2 = 4 marks]

Determine the value of the unknowns in the following diagrams:

(a)



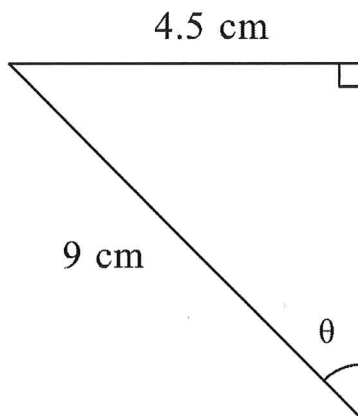
$$\cos(60) = \frac{x}{16} \quad \checkmark$$

$$\therefore 0.5 = \frac{x}{16}$$

$$\therefore x = 16 \times 0.5$$

$$\boxed{x = 8 \text{ cm}} \quad \checkmark$$

(b)



$$\sin(\theta) = \frac{4.5}{9} \quad \checkmark$$

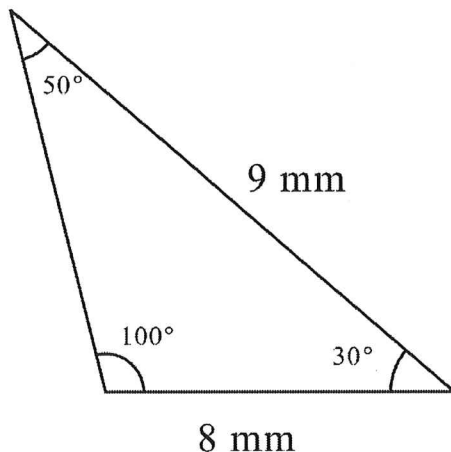
$$\sin(\theta) = \frac{1}{2}$$

$$\therefore \boxed{\theta = 30^\circ} \quad \checkmark$$

Question 2

[2 marks]

Determine the area of the following triangle.



$$\text{Area} = \frac{1}{2} \times 9 \times 8 \times \sin(30) \quad \checkmark$$

$$= \frac{1}{2} \times 9 \times 8 \times 0.5$$

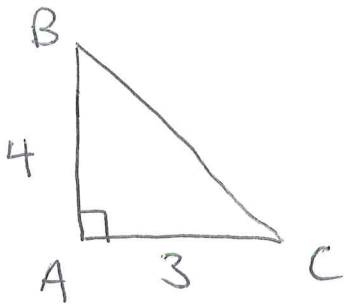
$$= 36 \times 0.5$$

$$= \boxed{18 \text{ mm}} \quad \checkmark$$

Question 3

[2 marks]

Triangle ABC has a right angle at A. If $\tan(B) = \frac{3}{4}$, find $\sin(C)$.



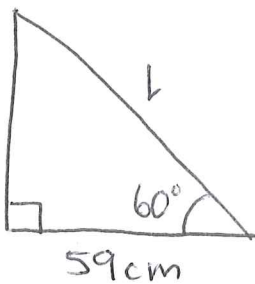
$$BC = 5 \quad \checkmark$$

$$\therefore \sin(C) = \frac{4}{5} \quad \checkmark$$

Question 4

[3 marks]

A closed umbrella was placed leaning against a vertical wall making an angle of 60° with the floor. If the umbrella's point of contact with the floor was 59 cm away from the base of the wall, draw a labelled diagram and determine the length of the umbrella.



$$\cos(60) = \frac{59}{L} \quad \checkmark$$

$$0.5 = \frac{59}{L}$$

$$\therefore L = \frac{59}{0.5}$$

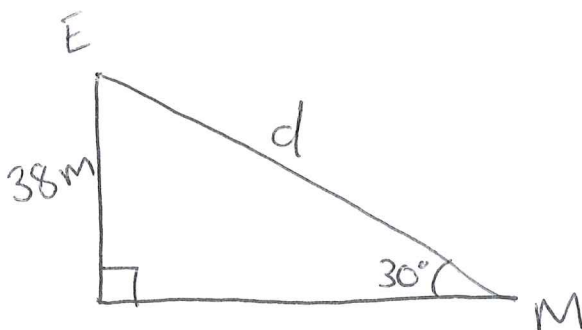
$$L = 118 \text{ cm} \quad \checkmark$$

Question 5

✓ diagram
(\perp , 59cm, 60°)

[3 marks]

An eagle was flying 38 metres above flat bushland when it spotted a mouse at an angle of depression of 30° . Draw a labelled diagram and determine the straight-line distance between the two animals.



✓ labels
(\perp , 38m, 30°)

$$\sin(30) = \frac{38}{d} \quad \checkmark$$

$$0.5 = \frac{38}{d}$$

$$\therefore d = \frac{38}{0.5}$$

$$d = 76 \text{ m} \quad \checkmark$$

Question 6

[4, 4 = 8 marks]

Packets of pasta are labelled as having a weight of 1 kg. The weights of these packets are normally distributed with a mean of 1.02 kg and a standard deviation of 0.02 kg.

(a) Determine the percentage of packets that will have a weight of:

(i) Less than 1.02 kg?

50% ✓

(ii) Between 1 kg and 1.04 kg?

68% ✓

(iii) Between 1.04 kg and 1.06 kg?

$$\frac{95}{2} - \frac{68}{2} = 47.5 - 34 = 13.5\%$$

(b) A customer picks up 10 random packets of pasta from the supermarket. How many packets are expected to weigh less than the labelled weight? (Round your answer to the nearest packet).

$$P(X < 1) = 100 - 50 - \frac{68}{2}$$

$$= 16\%$$

$$\Rightarrow 16\% \text{ of } 10 = 1.6$$

≈ 2 packets ✓

Question 7

[4, 2 = 6 marks]

Nichola's marks for her first semester exams in English, Maths and Chemistry were 65, 80 and 57.5 respectively. The mean (μ) and standard deviation (σ) for English were $\mu = 70$ and $\sigma = 2.5$, for Maths $\mu = 70$ and $\sigma = 5$ and for Chemistry $\mu = 50$ and $\sigma = 3$.

(a) Use z-scores to compare her exam results and hence determine which subject result was her best.

$$z_E = \frac{65 - 70}{2.5} = \frac{-5}{2.5} = -2$$

$$z_M = \frac{80 - 70}{5} = \frac{10}{5} = 2$$

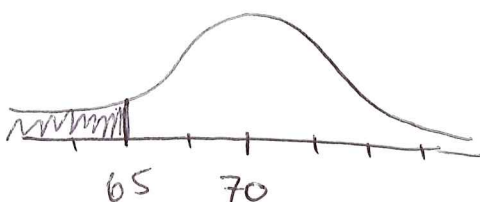
$$z_C = \frac{57.5 - 50}{3} = \frac{7.5}{3} = 2.5$$

∴ Chemistry was her best exam ✓

(b) What percentage of the class scored less than Nichola in her English exam?

$$P(X < 65) = \frac{100 - 95}{2}$$

$$= 2.5\%$$



MATHEMATICS APPLICATIONS

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TEST 5

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SECTION TWO – CALCULATOR ALLOWED

TIME: 30 mins

MARKS: / 34 marks

-1 units
-1 Rounding

STUDENT'S NAME: Solutions

CIRCLE YOUR TEACHER'S NAME:

Dr Duan

Mr Riemer

Mr Stillitano

Mr Galbraith

Miss Colquhoun

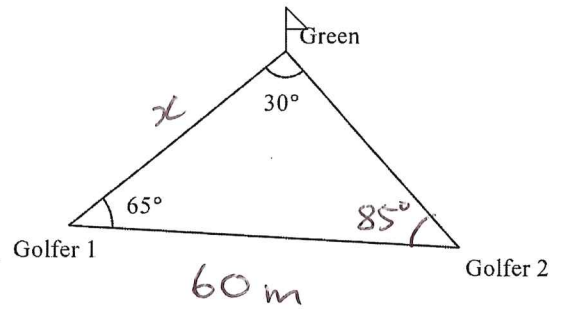
Ms Regi

1 x A4 page of notes, double sided allowed.
Up to three approved calculators allowed.
Show all necessary working to obtain full marks.
Formula sheet provided.

Question 8

[2, 2 = 4 marks]

Two golfers are aiming for a flag on the green.
The golfers are 60 metres apart in the diagram to the right.



- (a) Which golfer is the closest to the flag?
Give a valid reason for your answer.

Golfer 2 → shortest side opposite smallest angle.

- (b) Determine the distance Golfer 1 needs to hit a ball in order to hit the flag.

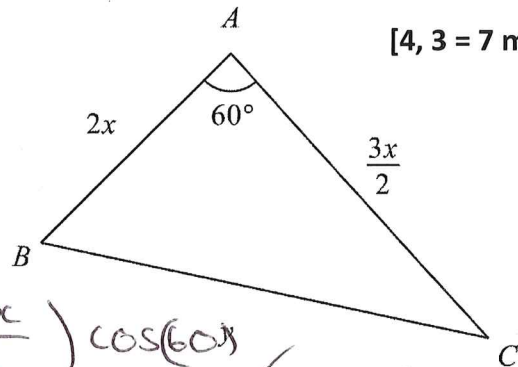
$$\frac{x}{\sin(85)} = \frac{60}{\sin(30)}$$

$$\therefore x = 119.54 \text{ m}$$

Question 9

The questions below refer to $\triangle ABC$ to the right.

[4, 3 = 7 marks]



- (a) Use the cosine rule to show that $y = \sqrt{\frac{13x^2}{4}}$

$$y^2 = (2x)^2 + \left(\frac{3x}{2}\right)^2 - 2(2x)\left(\frac{3x}{2}\right)\cos(60)$$

✓ correct subst.

$$y^2 = 4x^2 + \frac{9x^2}{4} - \frac{12x^2}{2} \times \frac{1}{2}$$

✓ starts simplifying

$$y^2 = \frac{16x^2}{4} + \frac{9x^2}{4} - \frac{12x^2}{4}$$

✓ common denominators

$$y^2 = \frac{13x^2}{4}$$

$$\therefore y = \sqrt{\frac{13x^2}{4}}$$

✓ square root

- (b) If $x = 3 \text{ cm}$, calculate the length of each side of the triangle.

$$c = 2(3) = 6 \text{ cm}$$

$$b = \frac{3(3)}{2} = 4.5 \text{ cm}$$

$$a = \sqrt{\frac{13(3)^2}{4}}$$

$$= 5.41 \text{ cm}$$

Question 10

[4, 4 = 8 marks]

The City of Canning are replacing several of the road hazard signs around Willetton, each of which are equilateral triangles with 750 mm side lengths. Each sign needs to be painted *front and back*, with a red strip around the exterior of the sign and a smaller equilateral triangle painted white in the centre with side lengths of 620 mm.

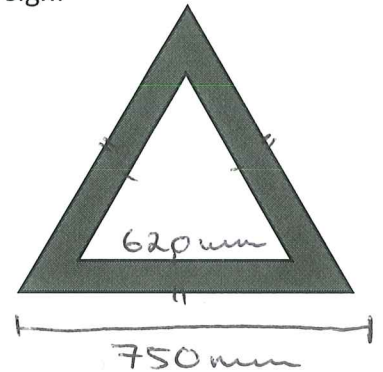
(a) Calculate the total area (in cm^2) that needs to be painted in white, on each sign.

$$\text{Area} = \frac{1}{2} \times 620 \times 620 \times \sin(60) \quad \checkmark \text{ formula}$$

$$= 166\,450.0826 \text{ mm}^2 \quad \checkmark \text{ ans}$$

$$\Rightarrow (\times 2) = 332\,900.1652 \text{ mm}^2 \quad \checkmark \times 2$$

$$= \boxed{3329 \text{ cm}^2} \quad \checkmark \text{ cm}^2$$



Heron's $S = 930$

(OR)

$$\text{Area} = \sqrt{930(930-620)^3} \quad \checkmark$$

$$= 166\,450.0826 \text{ mm}^2 \quad \checkmark$$

$$\Rightarrow (\times 2) = 332\,900.1652 \text{ mm}^2 \quad \checkmark$$

$$= \boxed{3329 \text{ cm}^2} \quad \checkmark$$

(b) Calculate the total area (in cm^2) that needs to be painted in red, on each sign.

$$\text{Area}_{\text{whole } \Delta} = \frac{1}{2} \times 750 \times 750 \times \sin(60) \quad \checkmark$$

$$= 243\,569.6448 \text{ mm}^2$$

$$\Rightarrow (\times 2) = 487\,139.2896 \text{ mm}^2 \quad \checkmark$$

$$= 4871.39 \text{ cm}^2$$

$$\text{Area}_{\text{red } \Delta} = 4871.39 - 3329 \quad \checkmark \text{ subtract}$$

$$= \boxed{1542.39 \text{ cm}^2} \quad \checkmark \text{ ans}$$

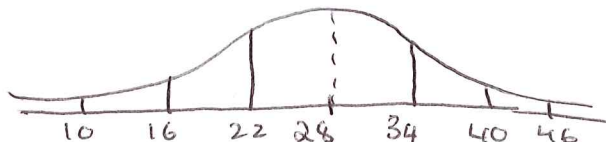
(OR)

Heron's $S = 1125$

$$\text{Area}_{\text{whole } \Delta} = \sqrt{1125(1125-750)^3} = 243\,569.6448 \text{ mm}^2 \quad \text{(then same as above)}$$

8

Question 11



[1, 1, 2, 3 = 7 marks]

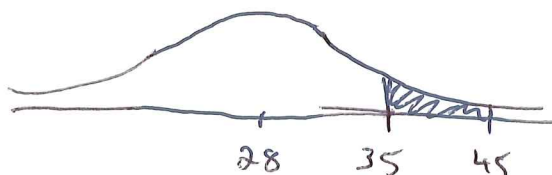
Jeriel likes to get to work before his boss in the morning. The time it takes him to get to work is normally distributed with a mean of 28 minutes and a standard deviation of 6 minutes.

- (a) If his boss arrives at work at 8:30 am every day and Jeriel leaves his house at 7:50 am, what is the probability of him arriving before his boss?



$$P(X < 40) = 0.9772$$

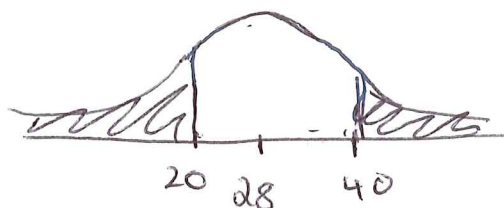
- (b) With Jeriel leaving his house at 7:50 am, what is the probability of him arriving 5 minutes either side of his boss's arrival?



$$P(35 < X < 45) = 0.1194$$

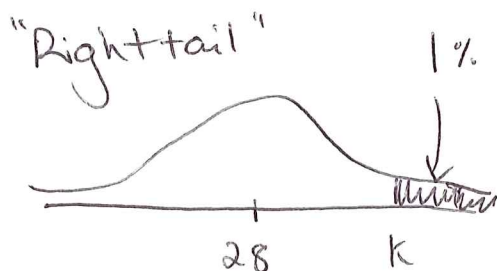
- (c) If Jeriel leaves his house at 8:00 am, what is the probability of him not arriving between 8:20 and 8:40 am?

Less than 20 mins
More than 40 mins



$$1 - P(20 < X < 40) = 1 - 0.8860 \text{ ✓ subtract.} = 0.1140 \text{ ✓}$$

- (d) What is the latest time that Jeriel should leave his house if he wants to cut the times he arrives after his boss to less than 1%?



$$P(X > k) = 0.01$$

$$\therefore k = 41.96 \text{ mins ✓}$$

$$\approx 42 \text{ mins ✓ correct rounding.}$$

Jeriel should leave no later than 7:48am ✓ time.

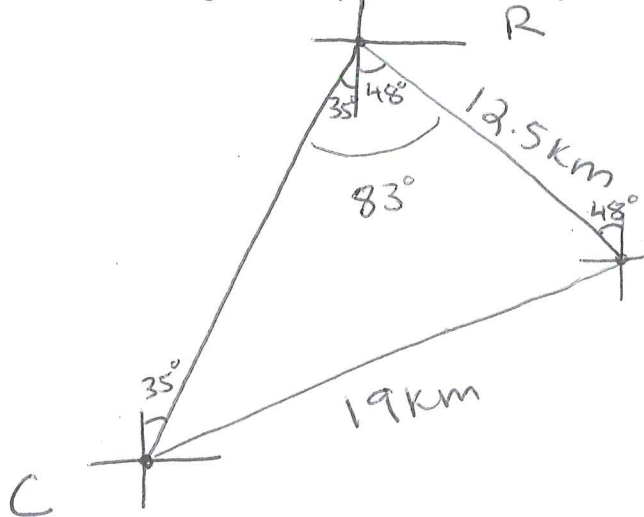
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Question 12

[2, 4, 2 = 8 marks]

The WSHS Maths Department decide to go on a boat cruise to celebrate the end of the year. The boat will leave from Fremantle port and travel to Rottnest Island which is 12.5 km away, on a bearing of 312° . After spending some time on Rottnest Island, the boat will then travel on a bearing of 215° to Carnac Island, before heading back to Fremantle Port, which is 19 km away from Carnac Island.

(a) Draw a labelled diagram to represent the boat journey.



✓ sides

✓ direction

(b) Determine the true bearing the boat needs to travel on to return back home to Fremantle port, from Carnac Island.

$$\frac{\sin(C)}{12.5} = \frac{\sin(83)}{19} \quad \checkmark$$

$$\therefore \boxed{C = 40.77^\circ} \quad \checkmark$$

✓ true bearing

$$\Rightarrow 40.77 + 35 = 75.77^\circ \quad \checkmark$$

$$= \boxed{075.77^\circ \text{ T}}$$

(c) Calculate the distance the boat will travel from Rottnest Island to Carnac Island.

$$\angle F = 180 - 83 - 40.77 = 56.23^\circ$$

$$\therefore RC^2 = 19^2 + 12.5^2 - 2 \times 19 \times 12.5 \times \cos(56.23) \quad \checkmark \text{ substitution}$$

$$RC = \sqrt{253.2163}$$

$$\boxed{RC = 15.91 \text{ km}} \quad \checkmark \text{ ans.}$$

OP

$$\frac{RC}{\sin(56.23)} = \frac{19}{\sin(83)}$$

End of Section 2

$$\therefore RC = 15.91 \text{ km} \quad \textcircled{8}$$

