



Semester One Examination Question/answer booklet

YR 10 MATHEMATICS EXTENSION

Section Two (calculator-assumed)

Student Name: _____

Time allowed for this section

Reading time before commencing work: 5 minutes
Working time for section: 80 minutes

Material required/recommended for this section

To be provided by the supervisor

Question/answer booklet for Section Two. Candidates may use the removable formula sheet from Section One

To be provided by the candidate

Standard items: pens, pencils, pencil sharpener, highlighter, eraser, ruler
Special items: drawing instruments, templates, notes on up to two unfolded sheets of A4 paper, and up to three calculators, CAS, graphic or scientific, which satisfy the conditions set by the Curriculum Council for this course.

Important note to candidates

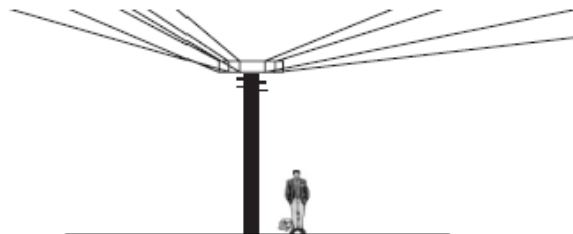
No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this examination

	Number of questions available	Number of questions to be attempted	Suggested working time (minutes)	Marks available
Section One Calculator—free	9	9	40 minutes	35
Section Two Calculator—assumed	10	10	80 minutes	65
Total marks				100

Instructions to candidates

1. Answer the questions in the spaces provided.
2. Spare answer pages are provided at the end of this booklet. If you need to use them, indicate in the original answer space where the answer is continued i.e. give the page number.
3. **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. Correct answers given without supporting reasoning may not be allocated full marks. Incorrect answers given without supporting reasoning cannot be allocated any marks. If you repeat an answer to any question, ensure that you cancel the answers you do not wish to have marked.
4. It is recommended that you **do not use pencil** except in diagrams.

Section Two: Calculator-assumed**65 Marks**This section has **ten (10)** questions. Attempt **all** questions**Question 1**

The picture shows a man standing next to a telegraph pole. The man and the telegraph pole are drawn to the same scale.

- (a) Write down an estimate for the height, in metres, of the man.

1.8m

✓

(1 mark)

- (b) Estimate the height, in metres, of this telegraph pole.

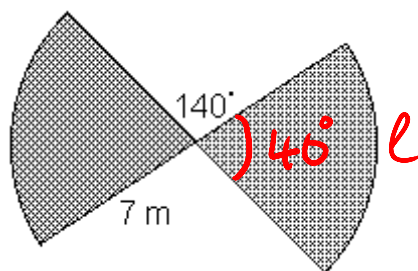
5m

✓

(1 mark)

Question 2

- (a) Find the perimeter of the shape below:



$$l = \frac{40}{360} \times 2\pi r$$

$$= \frac{1}{9} \times 2\pi \times 7$$

$$= 4.89 \text{ m}$$

✓

$$P = 2l + 4 \times 7$$

$$= 37.77 \text{ m}$$

✓

(3 marks)

- (b) Find the area of the shaded region above.

$$A = 2 \times \frac{40}{360} \times \pi r^2$$

✓

$$= \frac{2}{9} \times \pi \times 7^2$$

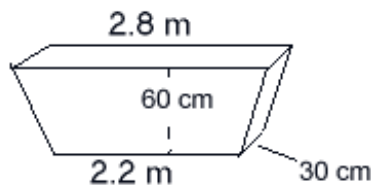
$$= 34.21 \text{ m}^2$$

✓

(2 marks)

Question 3

- (a) Find the volume of the following trapezoidal prism:



$$A = \frac{1}{2} (2.8 + 2.2) \times 0.6$$

$$= 1.5 \text{ m}^2 \quad \checkmark$$

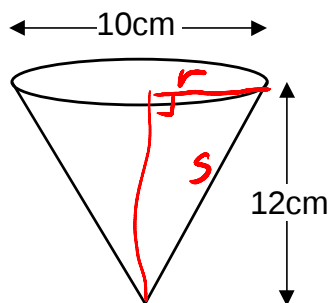
$$V = Ah$$

$$= 1.5 \times 0.3$$

$$= 0.45 \text{ m}^3 \quad \checkmark$$

(3 marks)

- (b) Find the exterior surface area of the following open cone, correct to 2 decimal places.



$$A = \pi r s \quad \checkmark$$

$$r = 5 \text{ cm} \quad \checkmark$$

$$s = \sqrt{5^2 + 12^2}$$

$$= 13 \text{ cm} \quad \checkmark$$

$$A = \pi \times 5 \times 13$$

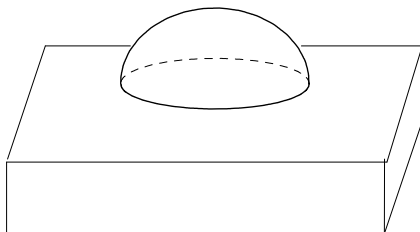
$$= 204.20 \text{ cm}^2 \quad \checkmark$$

(4 marks)

- (c) Find the outside surface area of this figure. It is a closed rectangular prism with a half sphere on the top.

The rectangular prism measures 45 cm long, 10 cm high and 20 cm wide.
The diameter of the hemisphere is 30 cm.

$$r = 15 \text{ cm}$$



$$SA = 2(lw + lh + wh) \quad \checkmark$$

$$- \pi r^2 \quad \checkmark$$

$$+ 2\pi r^2 \quad \checkmark$$

$$= 2(45 \times 10 + 10 \times 20 + 45 \times 20) + \pi \times 15^2$$

$$= 3806.86 \text{ cm}^2 \quad \checkmark$$

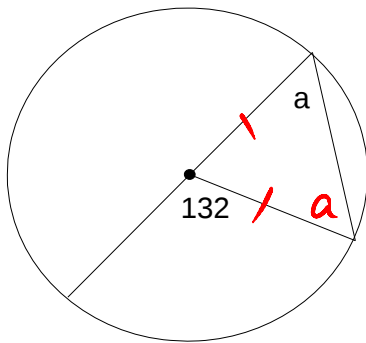
* Whoops 
1/2 Sphere 2 big.

(4 marks)

Question 4**(1, 2, 3, 3, 3, = 12 marks)**

Find the value of the letter in each of the following:

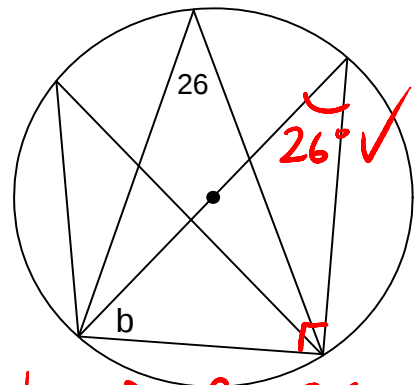
(a)



$$2a = 132$$

$$a = 66^\circ$$

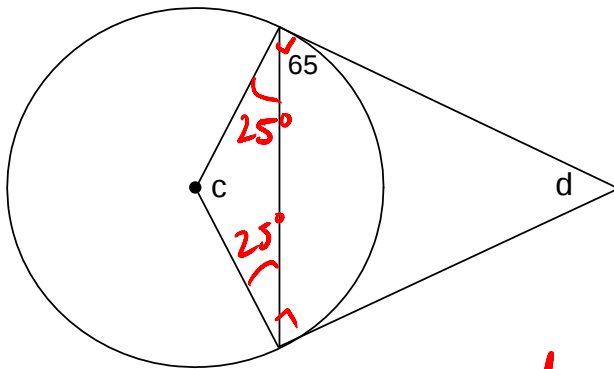
(b)



$$b = 180 - 90 - 26$$

$$= 64^\circ$$

(c)



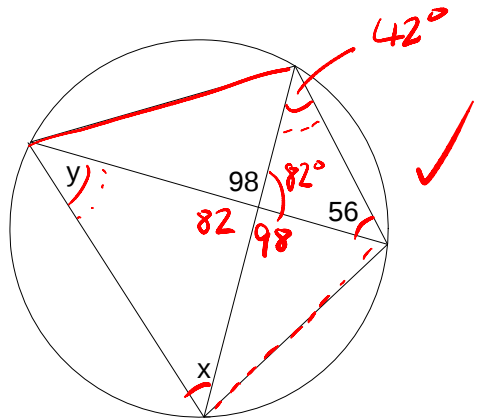
$$c = 180 - 2 \times 25$$

$$= 130^\circ$$

$$d = 180 - c$$

$$= 50^\circ$$

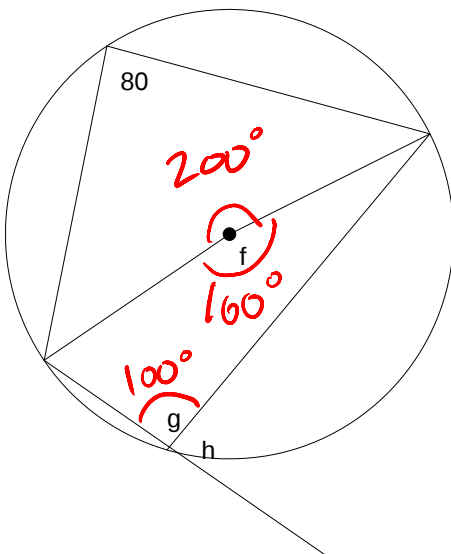
(d)



$$x = 56^\circ$$

$$y = 42^\circ$$

(e)



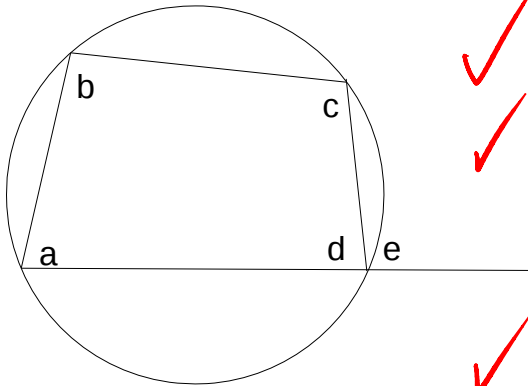
$$f = 160^\circ$$

$$g = 100^\circ$$

$$h = 80^\circ$$

Question 5

Write your own theorem concerning the exterior angle of a cyclic quadrilateral. (Giving reasons)



$$\checkmark \angle e = 180^\circ - \angle d \text{ (Supp.)}$$

$$\checkmark \angle d = 180^\circ - \angle b \text{ (opp. angles in cyc. quad.)}$$

$$\checkmark \therefore \angle e = \angle b$$

The exterior angle of a cyclic quadrilateral is equal to the opposite interior angle. ✓

(5 marks)

Question 6

The formula for the force (in Newtons) due to gravity between two objects of mass m and M kilograms positioned r metres apart is

$$f = \frac{GMm}{r^2}$$

where G is the gravitational constant 6.67×10^{-11} .

- a. Use this formula to find the force due to gravity between a 150kg space-walking astronaut and her 100 tonne spacecraft when they are 25m apart.

$$f = \frac{6.67 \times 10^{-11} \times 150 \times 100\,000}{25^2} \quad \checkmark \checkmark$$

$$= 1.6 \times 10^{-6} \text{ N} \quad \checkmark$$

(2 marks)

Question 7

Refer to the following airline itinerary:

Your Itinerary			
Date	Flight Number	Departing	Arriving
→ 01 Jun 2009	QF476	Perth 1350 Terminal 2 Domestic	Melbourne 1915 01 Jun 2009 Terminal 1
→ 04 Jun 2009	QF653	Melbourne 2015 Terminal 1 Domestic	Perth 2225 04 Jun 2009 Terminal 2

(Note: Perth is in time zone GMT+8 and Melbourne is in time zone GMT+10.)

- (a) How long is the flight from Perth to Melbourne scheduled to take?

$$1915 - 1350 = 5 \text{ h } 25 \text{ min}$$

$$5 \text{ h } 25 \text{ min} - 2 \text{ h} = 3 \text{ h } 25 \text{ min} \quad \checkmark \checkmark$$

(2 marks)

- (b) How long is the flight from Melbourne to Perth scheduled to take?

$$2225 - 2015 = 2 \text{ h } 10 \text{ min}$$

$$2 \text{ h } 10 \text{ min} + 2 \text{ h} = 4 \text{ h } 10 \text{ min} \quad \checkmark \checkmark$$

(2 marks)

- (c) The flight to Melbourne left on time but arrived 25 minutes late. The flight to Perth left 20 minutes late and landed 10 minutes late. Which flight took longer, and by how much?

$$P \rightarrow M \quad 3 \text{ h } 25 + 25 \text{ min} = 3 \text{ h } 50 \text{ min}$$

$$M \rightarrow P \quad 4 \text{ h } 10 \text{ min} - 10 \text{ min} = 4 \text{ h } 00 \text{ min}$$

Melbourne to Perth took longer by 10 min $\checkmark$

(2 marks)

Question 8

A water tank holds enough water to trickle irrigate 100 fruit trees for 6 hours.

- (a) How long would the tank last if it 40 more trees are to be watered? Answer to the nearest 10 minutes.

$$\begin{aligned}
 100 \times 6 &= 140 \text{ t} \quad \checkmark \\
 t &= \frac{600}{140} \\
 &= 4.29 \text{ hrs} \quad \checkmark \\
 &\approx 4 \text{ hours } 20 \text{ minutes} \quad \checkmark
 \end{aligned}$$

(3 marks)

- (b) Write the relationship between the time in hours t and the number of trees n using the $\propto$ symbol.

$$t \propto \frac{1}{n} \quad \checkmark$$

(1 mark)

- (c) Write the relationship between t and n as an equation using k to represent the constant of proportionality and hence determine k .

$$\begin{aligned}
 tn &= k \quad \checkmark \\
 6 \times 100 &= k \\
 k &= 600 \quad \checkmark
 \end{aligned}$$

(2 marks)

- (d) If a tree actually only needs 70 minutes of watering, how many trees could be watered from the tank?

$$\begin{aligned}
 \frac{70}{60} \times n &= 600 \quad \checkmark \\
 n &= 600 \times \frac{60}{70} \\
 &= 514 \text{ trees} \quad \checkmark
 \end{aligned}$$

(2 marks)

Question 9

The sensitive light meter registers a reading that is directly proportional to the luminous intensity of the light source, inversely proportional to the wavelength of the light and inversely proportional to the square of the distance from the light source.

Use the following pronumerals where appropriate:

- Let m be the meter reading
- Let I be the luminous intensity of the light source (in candela, cd)
- Let λ be the wavelength of the light (in nanometres, nm)
- Let d be the distance between light source and meter (in metres, m)

The meter is calibrated to read "1.00" using a light source of 1cd intensity with a wavelength of 555nm at a distance of 1m.

- (a) What will the meter read for the same light source at a distance of 10m (i.e. only d changes)?

$$\begin{aligned}
 m &\propto \frac{1}{d^2} \quad (\text{if nothing else changes}) \\
 md^2 &= k \\
 1 \times 1^2 &= m \times 10^2 \\
 m &= \frac{1}{100} \\
 &= 0.01 \quad \checkmark\checkmark
 \end{aligned}$$

(2 marks)

- (b) What will the meter read for a light source of 20cd intensity with a wavelength of 656nm at a distance of 3m?

$$\begin{aligned}
 m &= \frac{k I}{\lambda d^2} \quad \checkmark \\
 1 &= \frac{k \times 1}{555 \times 1^2} \quad \checkmark \\
 k &= 555 \\
 m &= \frac{555 \times 20}{656 \times 3^2} \\
 &= 1.88 \quad \checkmark
 \end{aligned}$$

(3 marks)

Question 10

For this question, point A is (-2,5) and point B is (10,10).

- (a) Find the distance between A and B

$$d = \sqrt{(10 - -2)^2 + (10 - 5)^2} = 13 \quad \checkmark \quad (1 \text{ mark})$$

- (b) Point C is the midpoint of A and B. Find the coordinates of C.

$$C = \left(\frac{-2 + 10}{2}, \frac{5 + 10}{2} \right) = (4, 7.5) \quad \checkmark \quad (1 \text{ mark})$$

- (c) Write an equation of the line that passes through point B and is parallel to the line $y = 2.4x + 2$

$$(y - 10) = 2.4(x - 10) \quad \checkmark \quad (2 \text{ marks})$$

- (d) Show that point A does not lie on the line $2x + \frac{3}{4}y + \frac{1}{2} = 0$

$$2(-2) + \frac{3}{4}(5) + \frac{1}{2} = \frac{1}{4} \neq 0 \quad \checkmark \quad (1 \text{ mark})$$

- (e) Find the equation of the circle centred at A that passes through B. (Use your answer to part (a) as the radius).

$$\begin{aligned} (x - -2)^2 + (y - 5)^2 &= 13^2 \\ (x + 2)^2 + (y - 5)^2 &= 169 \end{aligned} \quad \checkmark \quad (1 \text{ mark})$$

- (f) Find the equation of the line that passes through A and is perpendicular to the line AB.

$$\begin{aligned} m_{AB} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{10 - 5}{10 - -2} \\ &= \frac{5}{12} \end{aligned} \quad \checkmark$$

$\therefore$ The line is

$$\begin{aligned} (y - 5) &= -\frac{12}{5}(x - -2) \\ (y - 5) &= -\frac{12}{5}(x + 2) \end{aligned} \quad \checkmark \quad (2 \text{ marks})$$

Spare page for extra working.

END OF SECTION 2

Section 1

Question	Marks available	Marks achieved
1	2	
2	5	
3	6	
4	3	
5	4	
6	6	
7	3	
8	3	
9	3	
Total Section 1	35	

Section 2

Question	Marks available	Marks achieved
1	2	
2	5	
3	11	
4	12	
5	5	
6	3	
7	6	
8	8	
9	5	
10	8	
Total Section 1	65	

Section 1 + Section 2

Exam Total	100	
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