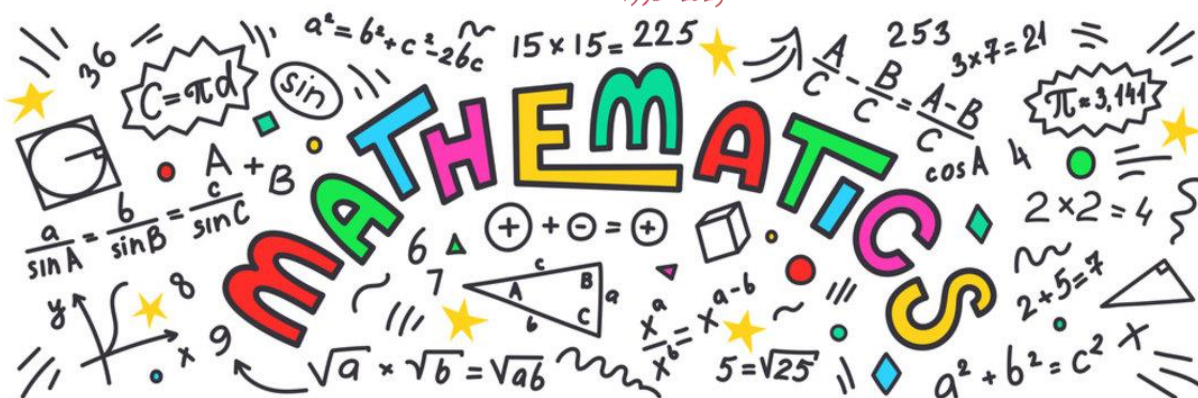


ST PETER'S



COLLEGE

1998 - 2023



PRELIMINARY EXAMINATION 2023

GRADE12: PAPER 2

EXAMINER: B. de Beer

TIME: 3 hours

MODERATORS: N. Lindsay, S. Dlamini, W. Khanyile

MARKS: 150

EXTERNAL MODERATOR:

SESSION: ONE

DATE: 18 SEPT 2023

NAME: Memo

MATH TEACHER:

Read the following instructions carefully.

1. This paper consists of 23 pages (including the cover page and additional working space) and 14 questions as well as a 2-page formula sheet. Please check that your paper is complete.
2. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
3. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers. **Answers only will NOT necessarily be awarded full marks.**
4. Diagrams are not necessarily drawn to scale.
5. If necessary, round off answers to **ONE** decimal place, unless otherwise stated.

	Section A							Section B							
Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Actual Mark															
Possible Mark	6	9	12	16	12	11	7	15	8	7	11	21	8	7	150
Marker's Signature															

SECTION A

Question 1

6 Marks

Grade 12 students plan to go on a cruise for their matric vacation and investigated the number of soft serve ice-creams that are served per day during a 7-day period. The results of the survey that was conducted are as follows:

Number of students (x)	45	67	122	98	47	88	110
Number of soft-serve ice creams (y)	50	120	167	111	25	155	177

- (a) Determine the equation of the regression line to 4 decimal places. (2)

$$y = -27,1194 + 1,7242x$$

$\checkmark a$ $\checkmark a$

- (b) Calculate the correlation co-efficient, to 4 decimal places and discuss the strength. (2)

$$r = 0,8922 \checkmark$$

Strong positive $\checkmark$

- (c) Can this model be used to calculate the number of ice-creams served if there were 15 matriculants? Justify your answer with a suitable calculation. (2)

$$y = -27,1194 + 1,7242(15) \checkmark$$
$$= -1,2579$$

∴ not possible
⇒ Extrapolation $\checkmark$



Simplify without the use of a calculator:

(a) $\frac{\cos^2(-325^\circ) - \sin^2 145^\circ}{\cos 20^\circ \cdot \tan 20^\circ}$ (5)

$$= \frac{\cos^2 35^\circ - \sin^2 35^\circ}{\cos 20^\circ \cdot \left(\frac{\sin 20^\circ}{\cos 20^\circ}\right)}$$

$$= \frac{\cos 70^\circ}{\sin 20^\circ}$$

$$= 1$$

(b) If $\sin 26^\circ = k$, express the following in terms of k :

(1) $\frac{1}{\sin 206^\circ}$ (2)

$$= \frac{1}{-\sin 26^\circ}$$

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

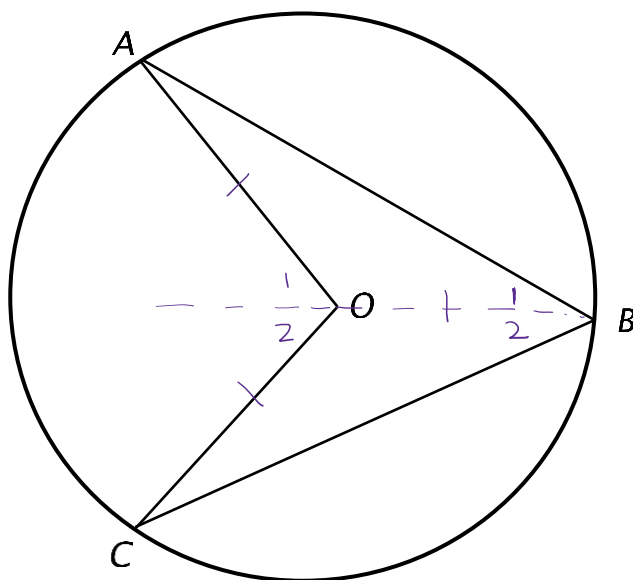
(2) $\cos 52^\circ$ (2)

$$= 1 - 2\sin^2 26^\circ$$

$$= 1 - 2k^2$$

- (a) Use the diagram below to prove the theorem that states:

"The angle at the centre of a circle is two times the angle at the circumference that is subtended by the same chord or arc."



To prove: $\widehat{AOC} = 2\widehat{B}$

(5)

$$\widehat{B}_1 = \widehat{A} \quad \checkmark$$

$$\widehat{O}_1 = 2\widehat{B}_1 \quad \checkmark$$

L's opp = radii
ext L's of Δ } $\checkmark$

$$\text{Similar } \left. \begin{array}{l} \widehat{B}_2 = \widehat{C} \\ \widehat{O}_2 = 2\widehat{B}_2 \end{array} \right\}$$

$$\begin{aligned} \Rightarrow \widehat{O}_1 + \widehat{O}_2 \\ = 2\widehat{B}_1 + 2\widehat{B}_2 \quad \checkmark \\ = 2\widehat{B} \end{aligned}$$

$$\therefore \widehat{AOC} = 2\widehat{B}$$

NB Study the correct version!

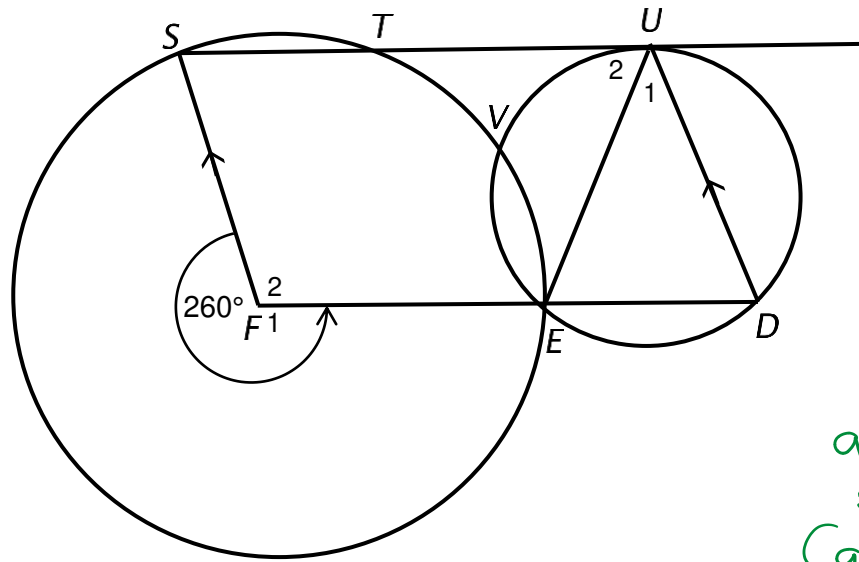
(b) Name any 2 properties of a cyclic quadrilateral.

* Opp L's Suppl ✓ a

* ext L = opp int L ✓ a

4 vertices on
the circumf is
the definition.
Not a property.

(c) In the diagram below F is the centre of the bigger circle with $\widehat{F}_1 = 260^\circ$. $SF \parallel UD$ and SU is a tangent to the smaller circle. The two circles intersect at V and E .



Some
assumed
Su // FD
Cannot say
 $\hat{S} + \hat{F}_2 = 180^\circ$
(5)

Prove, with statements and reasons that $SFEU$ is cyclic.

$$\hat{F}_2 = 100^\circ \quad \checkmark a$$

$$\hat{D} = 80^\circ \quad \checkmark a$$

$$U_2 = 80^\circ \quad \checkmark \quad a$$

L's around a pnt
 co-int L's, SF // UD
 tan-chord th

$$\Rightarrow \hat{F}_2 + \hat{U}_2 = 180^\circ$$

SFEU is cyclic

opp < supply ✓ a

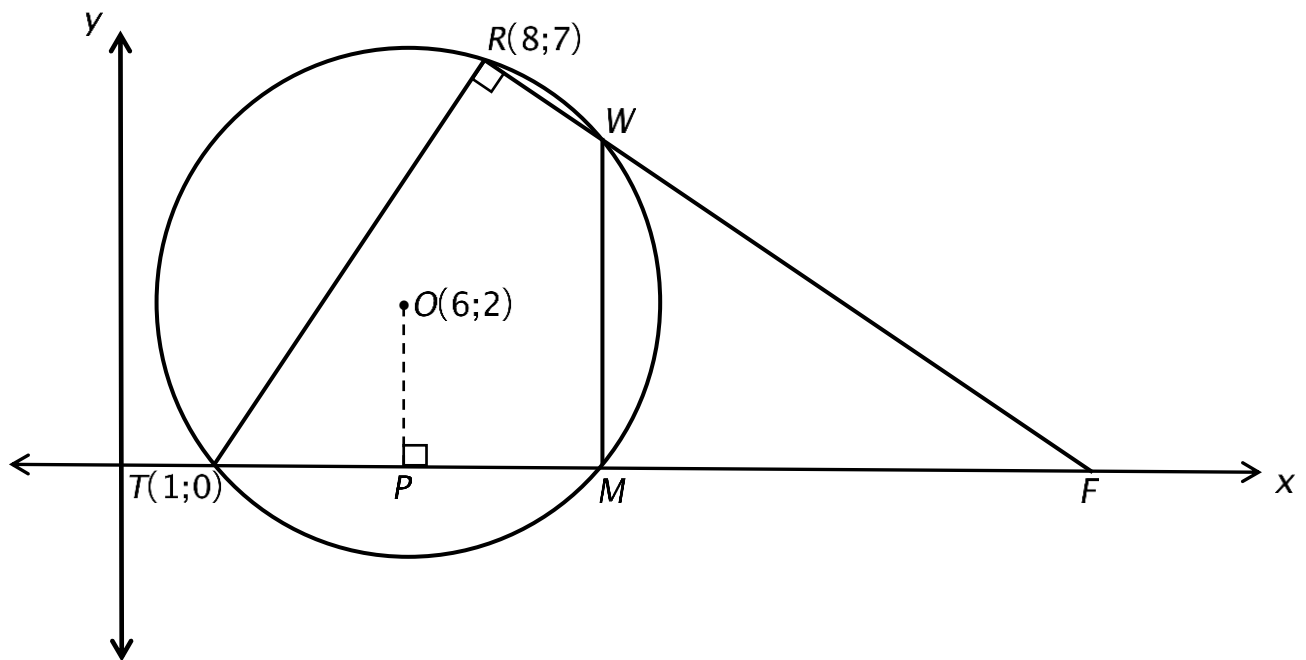
or

Converse of opp L's of c.g.
Not a mixture between 2!

Question 4

16 Marks

In the diagram below, circle with centre $O(6;2)$ has 4 points on the circumference. $R(8;7)$, W , M and $T(1;0)$. $OP \perp TM$ and RW is produced to F . TW is not a diameter.



- (a) Give a reason why $\widehat{WMT} = 90^\circ$? (1)

opp $\angle$ s of cyclic quad suppl $\checkmark a$

- (b) Prove that $\widehat{RTM} = 45^\circ$. (3)

$$m_{RT} = \frac{7-0}{8-1} \quad \checkmark m$$

$$= 1 \quad \checkmark a$$

$$\Rightarrow \tan \widehat{RTM} = 1 \quad \checkmark a$$

$$\widehat{RTM} = 45^\circ$$

- (c) (1) Calculate the radius of the circle and leave answer in simplest surd form. (2)

$$\begin{aligned} r &= \sqrt{(8-6)^2 + (7-2)^2} \quad \checkmark m \\ &= \sqrt{2^2 + 5^2} \\ &= \sqrt{29} \quad \checkmark a \end{aligned}$$

- (2) Hence, write down the equation of circle O. (2)

$$\underbrace{(x-6)^2 + (y-2)^2}_{\checkmark a} = \underbrace{29}_{ca} \quad \checkmark$$

- (d) Give a reason why $TP = PM$? (1)

$\perp$ line from centre
 $\checkmark a$

- (e) State the co-ordinates of (no working out is necessary):

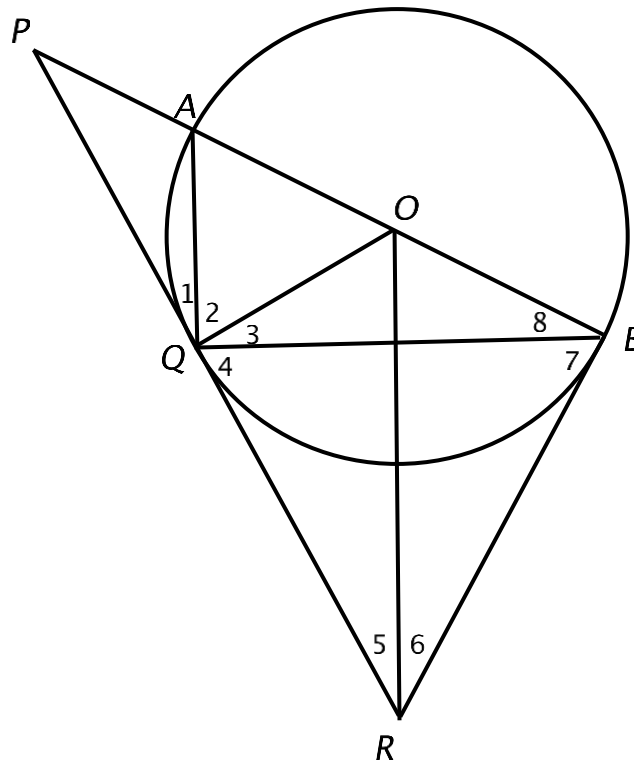
(1) $M(\underbrace{11}_{\checkmark a}; \underbrace{0}_{\checkmark a})$ (2)

(2) $W(\underbrace{11}_{\checkmark a}; \underbrace{4}_{\checkmark a})$ (2)

- (f) Find the equation of straight line RWF . (3)

$$\begin{aligned} y &= -x + c \quad \checkmark a \quad (8; 7) \\ 7 &= -8 + c \quad \checkmark a \\ c &= 15 \\ \Rightarrow y &= -x + 15 \quad \checkmark ca \end{aligned}$$

In the diagram below RQ and RB are tangents to the circle with centre O at the points Q and B respectively. The radius BO produced, meets the circle at A and RQ produced at P . $RBOQ$ is a cyclic quadrilateral. Let $\hat{Q}_1 = x$.



(a) Name, with reasons, 4 other angles equal to x .

(5)

$$\begin{array}{ll}
 \hat{B}_8 = x & \checkmark a \quad \text{tan-chord th} \\
 \hat{Q}_3 = x & \checkmark a \quad \text{L'S opp = radii} \\
 \hat{R}_6 = x & \checkmark a \\
 \hat{R}_5 = x & \checkmark a \quad \text{L'S in same segment}
 \end{array}
 \quad \left. \vphantom{\begin{array}{l} \hat{B}_8 = x \\ \hat{Q}_3 = x \\ \hat{R}_6 = x \\ \hat{R}_5 = x \end{array}} \right\} \checkmark a$$

(b) Express $\hat{P}$ in terms of x .

(3)

$$\begin{array}{ll}
 \hat{Q}_1 + \hat{Q}_2 = 90^\circ & \checkmark a \\
 \Rightarrow \hat{P} = 180^\circ - 90^\circ - 2x & \text{tan} \perp \text{radii} \\
 = 90^\circ - 2x & \checkmark a \quad \text{L'S of } \triangle
 \end{array}
 \quad \left. \vphantom{\begin{array}{l} \hat{Q}_1 + \hat{Q}_2 = 90^\circ \\ \hat{P} = 180^\circ - 90^\circ - 2x \\ = 90^\circ - 2x \end{array}} \right\} \checkmark a$$

(c) (1) If the radius of the circle is r units, show that $OP = \frac{r}{\cos 2x}$. (1)

$$\frac{OP}{r} = \frac{1}{\sin(90^\circ - 2x)} \quad \checkmark a$$

$$OP = \frac{r}{\cos 2x}$$

(2) Hence, or otherwise, show that $AP = \frac{r(1 - \cos 2x)}{\cos 2x}$. (3)

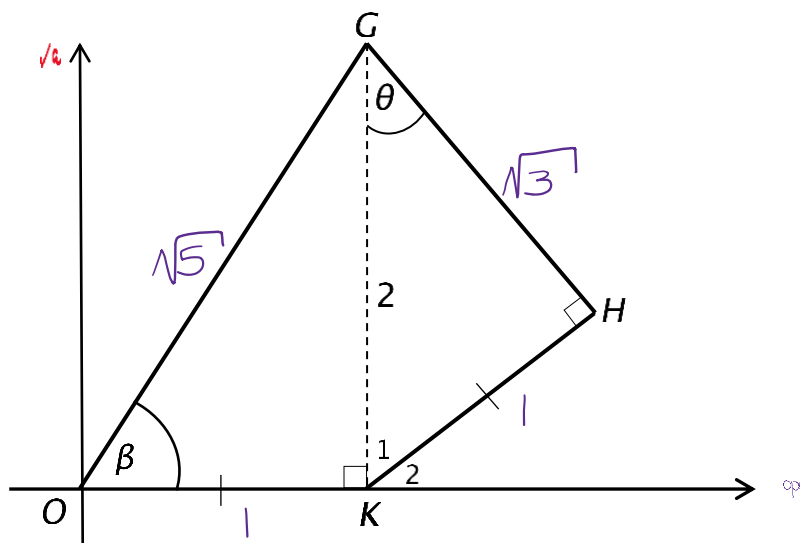
$$AP = OP - r$$

$$= \frac{r}{\cos 2x} - r \quad \checkmark m$$

$$= \frac{r - r \cdot \cos 2x}{\cos 2x} \quad \begin{array}{l} \checkmark \text{ num} \\ \checkmark \text{ denom} \end{array}$$

$$= \frac{r(1 - \cos 2x)}{\cos 2x}$$

In the diagram below $\sin \beta = \frac{2}{\sqrt{5}}$ units. $OK = KH$, $GH \perp HK$, $GK \perp OK$ and $\widehat{KGH} = \theta$.



- (a) Write down the length of OG if $GK = 2$ units. (1)

$\sqrt{5}$ units ✓ a

- (b) Hence, calculate the length of KH . (2)

$$\begin{aligned} OK^2 &= (\sqrt{5})^2 - 2^2 \quad \checkmark a \\ &= 1 \\ OK &= 1 \\ \Rightarrow KH = OK = 1 \quad \checkmark ca \end{aligned}$$

- (c) Evaluate: $\cos(\beta + \theta)$, without the use of a calculator. (4)

$$\begin{aligned} &= \cos \beta \cdot \cos \theta - \sin \beta \cdot \sin \theta \quad \sqrt{3} \checkmark a \\ &= \left(\frac{1}{\sqrt{5}} \right) \cdot \left(\frac{\sqrt{3}}{2} \right) - \left(\frac{2}{\sqrt{5}} \right) \left(\frac{1}{2} \right) \quad \checkmark a \text{ subst ratios} \\ &= \frac{\sqrt{3} - 2}{2\sqrt{5}} \quad \checkmark ca \end{aligned}$$

(d) Prove that OG is not parallel to KH .

(4)

$$\begin{aligned}\sin \beta &= \frac{2}{\sqrt{5}} \\ &= 63,4^\circ \quad \checkmark \quad a \\ \sin \hat{K}_1 &= \frac{\sqrt{3}}{2} \\ \hat{K}_1 &= 60^\circ \quad \checkmark \quad a \\ \hat{K}_2 &= 30^\circ \quad \checkmark \quad a \\ \Rightarrow \text{corresp } \angle\text{'s} &\neq \quad \checkmark \quad \text{conclusion}\end{aligned}$$

Question 7

7 Marks

$$V = \frac{4}{3}\pi.r^3 \quad \text{and} \quad V = \frac{1}{3}\pi.r^2.h$$

Welcome drinks are served in cone-shaped glasses with ball-shaped ice cubes.

The following information is known:

- ◆ The slant height of the glass is 8 cm.
- ◆ The radius of the glass is $\sqrt{28}$ cm.

The waiters fill **three quarters** of the glass with liquid and then put **6** ice cubes in to fill the glass to the top.

IB

$$\begin{aligned}V &\rightarrow \perp h \\ SA &\rightarrow sh\end{aligned}$$



(3)

(a) Show that the volume of the liquid in the glass is $42\pi \text{ cm}^3$.

$$\begin{aligned}\perp h^2 &= 8^2 - (\sqrt{28})^2 \\ &= 36 \\ \perp h &= 6 \text{ cm} \quad \checkmark \quad a \\ V &= \frac{3}{4} \left(\frac{1}{3} \pi (\sqrt{28})^2 \times 6 \right) = 42\pi \text{ cm}^3\end{aligned}$$

Up to $56\pi \rightarrow \frac{2}{3}$

(b) Hence, calculate the radius of one ice cube.

(4)

$$\begin{aligned}\checkmark a \quad 14\pi &= \checkmark a \quad 6 \left(\frac{4}{3} \pi r^3 \right) \\ \frac{14}{6} &= \frac{4}{3} r^3 \\ r &= \sqrt[3]{1,75} \quad \checkmark m \\ &= 1,2 \text{ cm} \quad \checkmark ca\end{aligned}$$

Make sure you use ALL information correctly!

SUB-TOTAL SECTION A: 72

SECTION B

Question 8

15 Marks

(a) Given: $x = 4 \cos \beta$ and $y = 3 - 5 \sin \beta$.

(1) Determine $x^2 + y^2$ and simplify.

(3)

$$\begin{aligned}
 &= (4 \cos \beta)^2 + (3 - 5 \sin \beta)^2 \quad \checkmark \text{subst} \\
 &= \underbrace{16 \cos^2 \beta}_{\checkmark a} + \underbrace{9 - 30 \sin \beta + 25 \sin^2 \beta}_{a \quad \checkmark} \rightarrow
 \end{aligned}$$

(2) Hence, prove that $\sqrt{x^2 + y^2} = 5 - 3 \sin \beta$

(3)

$$\begin{aligned}
 &= \sqrt{16(1 - \sin^2 \beta) + 9 - 30 \sin \beta + 25 \sin^2 \beta} \quad \checkmark a \\
 &= \sqrt{16 - 16 \sin^2 \beta + 9 - 30 \sin \beta + 25 \sin^2 \beta} \\
 &= \sqrt{25 - 30 \sin \beta + \cancel{9 \sin^2 \beta}} \quad \checkmark a \\
 &= \sqrt{(5 - 3 \sin \beta)^2} \quad \checkmark a \\
 &\quad \underline{5 - 3 \sin \beta} \rightarrow
 \end{aligned}$$

(b) Prove the identity: $\cos P(1 - \tan^2 P) = \frac{\cos 2P}{\cos P}$ (3)

$$\begin{aligned}
 \text{LHS} &= \cos P - \cos P \left(\frac{\sin^2 P}{\cos^2 P} \right) \quad \checkmark^a \quad \checkmark^m \quad (\text{remaining br.}) \\
 &= \cos P - \frac{\sin^2 P}{\cos P} \\
 &= \frac{\cos^2 P - \sin^2 P}{\cos P} \quad \checkmark^a \quad \checkmark^a \\
 &= \frac{\cos 2P}{\cos P} = \text{RHS}
 \end{aligned}$$

$\cos P \left(1 - \frac{\sin^2 P}{\cos^2 P} \right)$
 $\cos P \left(\frac{\cos^2 P - \sin^2 P}{\cos^2 P} \right)$

(c) Find the general solution of $\cos 54^\circ \cdot \cos x + \sin 54^\circ \cdot \sin x = \sin 2x$ (6)

$$\begin{aligned}
 \cos(54^\circ - x) &= \sin 2x \quad \checkmark^a \\
 &= \cos(90^\circ - 2x) \quad \checkmark^a
 \end{aligned}$$

Q1 : $54^\circ - x = 90^\circ - 2x + k360^\circ \quad \checkmark^m$

$$\begin{aligned}
 +x &= 36^\circ + k360^\circ \\
 x + 36^\circ + k360^\circ &\rightarrow, k \in \mathbb{Z} \quad \checkmark^a
 \end{aligned}$$

Q4 : $54^\circ - x = 360^\circ - (90^\circ - 2x) + k360^\circ \quad \checkmark^m$

$$\begin{aligned}
 &= 270^\circ + 2x + k360^\circ \\
 -3x &= 216^\circ + k360^\circ \\
 x &= -72^\circ - k120^\circ \quad \checkmark
 \end{aligned}$$

⊖ if no $k \in \mathbb{Z}$

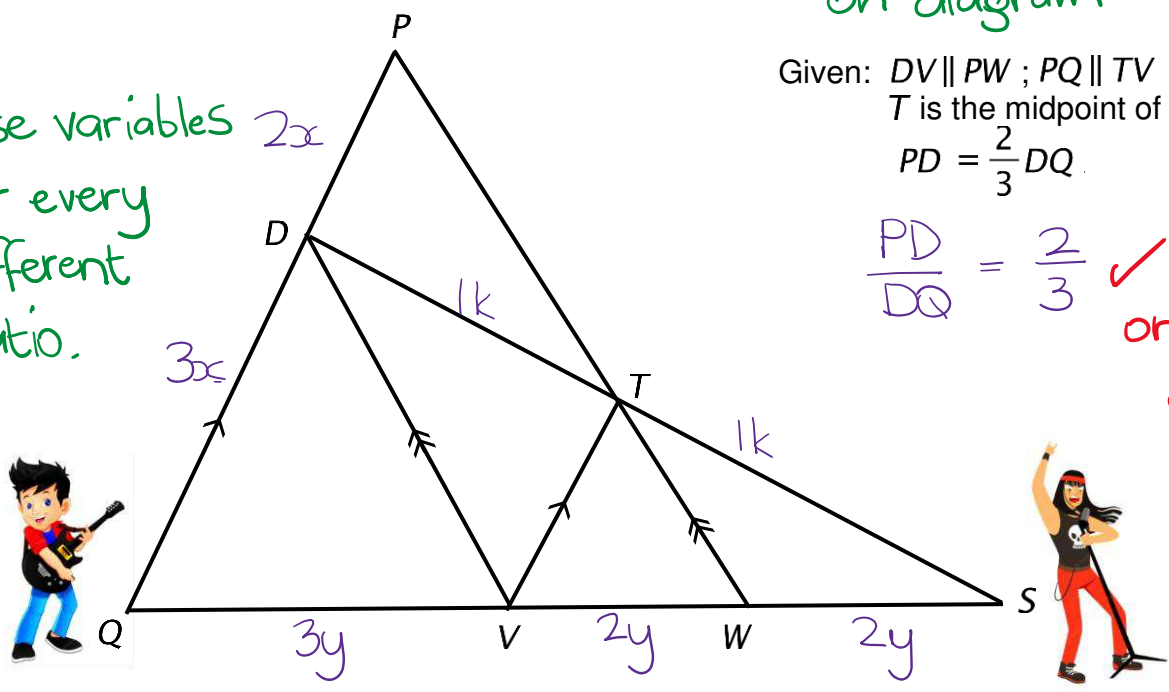
A rock band provides live entertainment on stage. The singer is very particular about where the band members are positioned to have an amazing performance. This floorplan is indicated on the diagram below.

NB With ratios → indicate on diagram

Given: $DV \parallel PW$; $PQ \parallel TV$
 T is the midpoint of DS
 $PD = \frac{2}{3} DQ$

$$\frac{PD}{DQ} = \frac{2}{3} \quad \checkmark \quad \text{or on diagram}$$

Use variables for every different ratio.



(a) Determine the ratios of:

(1) $QV : VW = 3 : 2$ $\checkmark$ a
 No fractions in answers $\therefore$ not $1 : \frac{2}{3}$ } prop th or a line $\parallel$ to 1 side of $\triangle$ (3)

(2) $VW : WS = 1 : 1$ $\checkmark$ a (1)

(b) Determine the distance from the Guitarist (Q) to the Singer (S) if $QV = 1,5 \text{ m}$. (2)

$$\begin{aligned} 3y &= 1,5 \\ y &= 0,5 \end{aligned} \Rightarrow \text{Distance: } 7y \checkmark \text{ m} \\ = 7(0,5) \\ = 3,5 \text{ m} \checkmark \text{ a}$$

(c) Determine: $\frac{\text{Area } \triangle DSV}{\text{Area } \triangle STV} = \frac{\frac{1}{2} \times 2k \times b}{\frac{1}{2} \times 1k \times b} \checkmark \text{ m}$ (2)

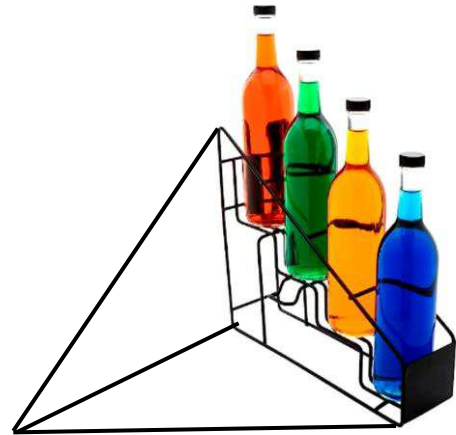
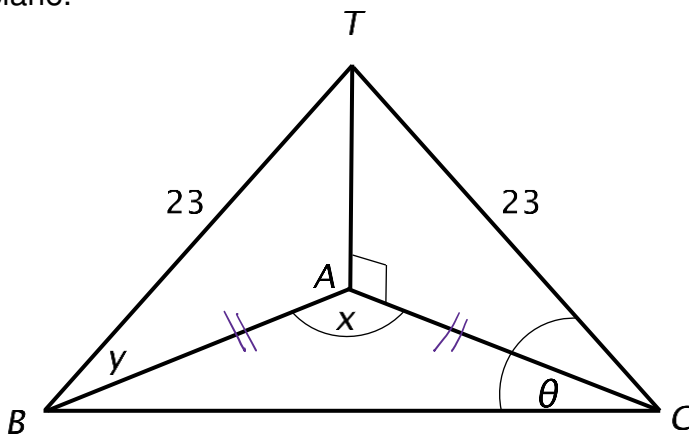
"area rule" $\rightarrow$ sin @ the end

Or $\perp h$ and b , then indicate $\perp h$ $= 2 \checkmark \text{ ca}$

Question 10

7 Marks

The diagram below shows a stand that is built to carry the cooldrink bottles to the serving area. $TB = TC = 23$, $\widehat{ABT} = y$, $\widehat{BAC} = x$ and $\widehat{TCB} = \theta$. A , B and C are in the same horizontal plane.



- (a) Prove that area $\Delta ABC = \frac{529}{2} \sin x \cdot \cos^2 y$. (3)

$$\frac{AB}{23} = \cos y \quad \checkmark a$$

$$AB = 23 \cos y = AC \quad \checkmark a$$

- (b) Show that $BC = 23\sqrt{2 + 2 \cos 2\theta}$ (4)

$$\widehat{BTC} = \theta$$

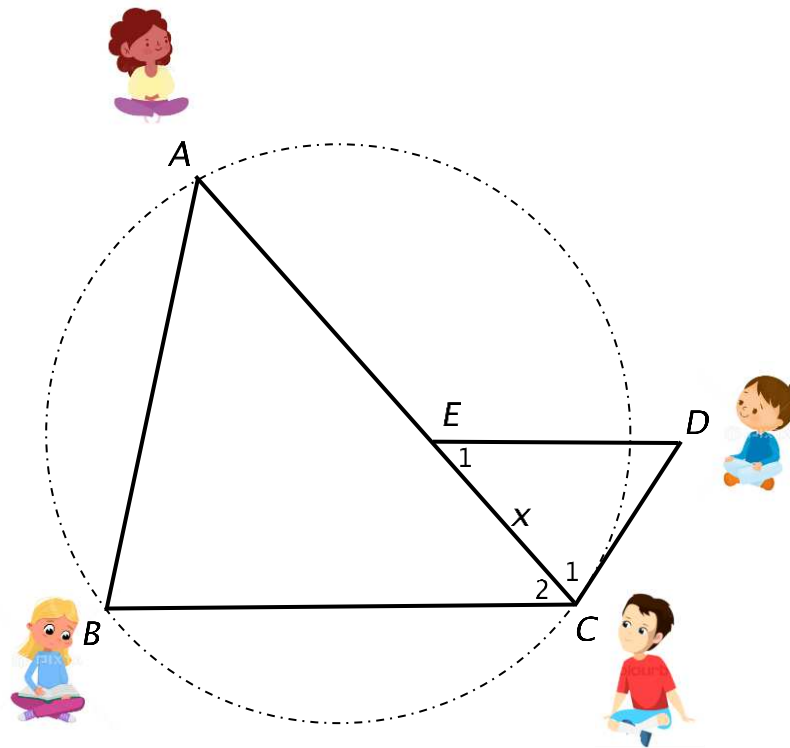
$$\widehat{BTC} = 180^\circ - 2\theta \quad \checkmark a$$

$$\begin{aligned} \Rightarrow BC^2 &= 23^2 + 23^2 - 2(23)(23) \cos(180^\circ - 2\theta) \quad \checkmark m \\ &= 2(23)^2 - 2(23)^2 (-\cos 2\theta) \quad \checkmark a \\ &= 2(23)^2 [1 + \cos 2\theta] \quad \checkmark \text{fact} \\ &= 23^2 [2 + 2 \cos 2\theta] \end{aligned}$$

$$\therefore BC = 23 \sqrt{2 + 2 \cos 2\theta}$$

For a certain game, people need to sit in a specific formation. The cruise director, with a bit of mathematical background, created the diagram below so that the same game can be played at different entertainment areas. Four people, Amber (A), Beth (B), Chris (C) and Dann (D) sit as indicated.

In the diagram below CD is a tangent to the circum-circle of $\triangle ABC$. $ED \parallel BC$, $AE = BC = 8\text{ m}$, $ED = 6\text{ m}$, $CD = 5\text{ m}$ and $EC = x\text{ metres}$.



(a) Prove that: $AB \cdot CE = DC \cdot BC$

(5)

In $\triangle ABC$ and $\triangle DCE$

1. $\hat{B} = \hat{C}_1$ ✓ a tan-chord th
2. $\hat{C}_2 = \hat{E}_1$ ✓ a alt $\angle$'s, $ED \parallel BC$
3. $\hat{A} = \hat{D}$ 3rd $\angle$ of $\triangle$ ✓ a

$\Rightarrow \triangle ABC \parallel \triangle DCE$ $\angle\angle\angle$ ✓ a

$$\therefore \frac{AB}{DC} = \frac{BC}{CE} = \frac{AC}{DE} \quad \checkmark a$$

$$\Rightarrow AB \cdot CE = DC \cdot BC$$

(b) Show that $x^2 + 8x = 48$.

(2)

$$\frac{AC}{DE} = \frac{BC}{CE}$$

$$\therefore \left\{ \frac{x+8}{6} = \frac{8}{x} \right\} \checkmark$$

$$\therefore x^2 + 8x = 48$$

(c) Solve for x.

(2)

$$x^2 + 8x - 48 = 0 \quad \checkmark a$$

$$(x+12)(x-4) = 0$$

$$\therefore \underbrace{x = -12}_{\text{h.a.}} \quad \text{or} \quad x = 4 \quad \checkmark a$$

(d) How far in metres is Amber placed from Beth?

(2)

$$\frac{AB}{5} = \frac{8}{4} \quad \checkmark \text{ca if pos number}$$

$$\begin{aligned} AB &= 2 \times 5 \\ &= 10\text{m} \quad \checkmark \text{ca} \end{aligned}$$

A printing company agreed to print logos on the t-shirts of a group of Grade 12s that are going to wear it when embarking on the ship. However, the printing machine needs the correct formulas to code the printer.

- ▲ circles M and N that touch externally:

$$M : x^2 + 4x + y^2 - 2y + k = 0$$

$$N : (x - 7)^2 + (y + 8)^2 = 72$$

- ▲ 2 tangents form the sides of the glass. They are symmetrical in the $x = 7$ line:

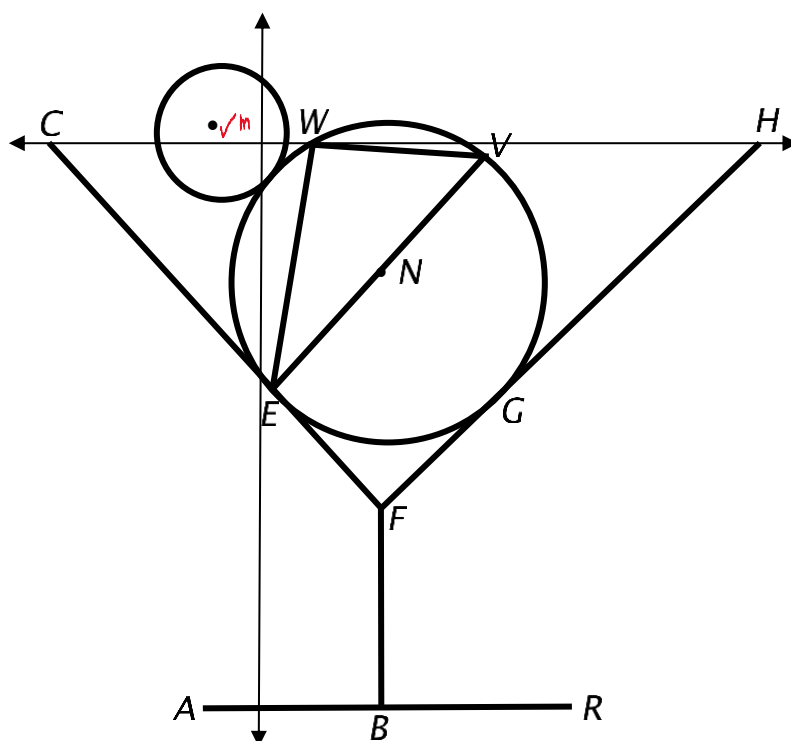
$$CF \text{ that touches the circle } N \text{ at } E : y = -x - 13 \quad x \in [-13; 7]$$

$$HF \text{ that touches the circle } N \text{ at } G : y = ax + q \quad x \in [7; 27]$$

- ▲ the stem of the glass FB that is perpendicular to the foot of the glass ABR . $AB = BR$.

- ▲ a wafer EVW , where EV is the diameter of circle N and W the intersection on the x-axis.

- ▲ $//$, W and H are x-intercepts.



- (a) Determine the equation of FH if $\widehat{EFG} = 90^\circ$.

(3)

$$y = x + q \quad (27; 0)$$

$$0 = 27 + q$$

$$q = -27$$

$$\Rightarrow y = x - 27$$

- (b) Hence, prove that the coordinates of F are $(7; -20)$. (2)

subst in any eq

$$\Rightarrow \left. \begin{array}{l} y = -7 - 13 \checkmark m \\ \quad \quad \quad = -20 \checkmark a \end{array} \right\} \text{ or } \left. \begin{array}{l} y = 7 - 27 \checkmark m \\ \quad \quad \quad = -20 \checkmark a \end{array} \right\}$$

$$\Rightarrow U(7; -20)$$

- (c) If $FB = 20$ units, and $AR = 16$ units, determine the coordinates of A . (2)

$$A(-1; -40)$$

$\checkmark a \quad \checkmark a$

- (d) Calculate the value of k if $MN = 9\sqrt{2}$. (6)

$$R + r = 9\sqrt{2} \checkmark m$$

$$r = 9\sqrt{2} - \sqrt{72}$$

$$= 3\sqrt{2} \checkmark a$$

$$(x^2 + 4x + 4) + (y^2 - 2y + 1) = -k + 5$$

$$\underline{(x+2)^2 + (y-1)^2} \checkmark a = \underline{-k+5} \checkmark a$$

$$\Rightarrow -k+5 = (3\sqrt{2})^2 \checkmark ca$$

$$-k = 18 - 5$$

$$k = -13 \checkmark ca$$

- (e) Calculate $\widehat{WEV}$ rounded off to the nearest degree if $WE: 3y = 14x - 56$, $E(1; -14)$ and $W(4; 0)$. (5)

$$y = \frac{4}{3}x + \frac{56}{3} \checkmark a$$

$$\tan \theta = \frac{4}{3} \checkmark a$$

$$\theta = 77,90524 \dots^\circ$$

$$m_{EV} = \tan \beta = 1 \checkmark a$$

$$\beta = 45^\circ \checkmark a$$

$$\therefore \widehat{WEV} = 77,9^\circ - 45^\circ$$

$$= 33^\circ \checkmark ca$$

$$\widehat{W} = 90^\circ \quad \angle \text{in semi-circle} \checkmark a$$

$$WE = \sqrt{(4-1)^2 + (-14-0)^2}$$

$$= \sqrt{205} \checkmark a$$

$$EV = 2\sqrt{72} \checkmark a$$

$$\cos \widehat{WEV} = \frac{\sqrt{205}}{2\sqrt{72}} \checkmark a$$

$$\widehat{WEV} = 32,46 \dots$$

$$= 32^\circ \checkmark ca$$

- (f) Hence, calculate the area of the wafer, ΔWEV . (3)

$$\begin{aligned} \text{Area} &= \frac{1}{2} \times \sqrt{205} \times 2\sqrt{72} \times \sin 33^\circ \\ &= 66,2 \text{ u}^2 \end{aligned}$$

if use $\sin 32^\circ$
 $\rightarrow = 64,4 \text{ u}^2$

Question 13

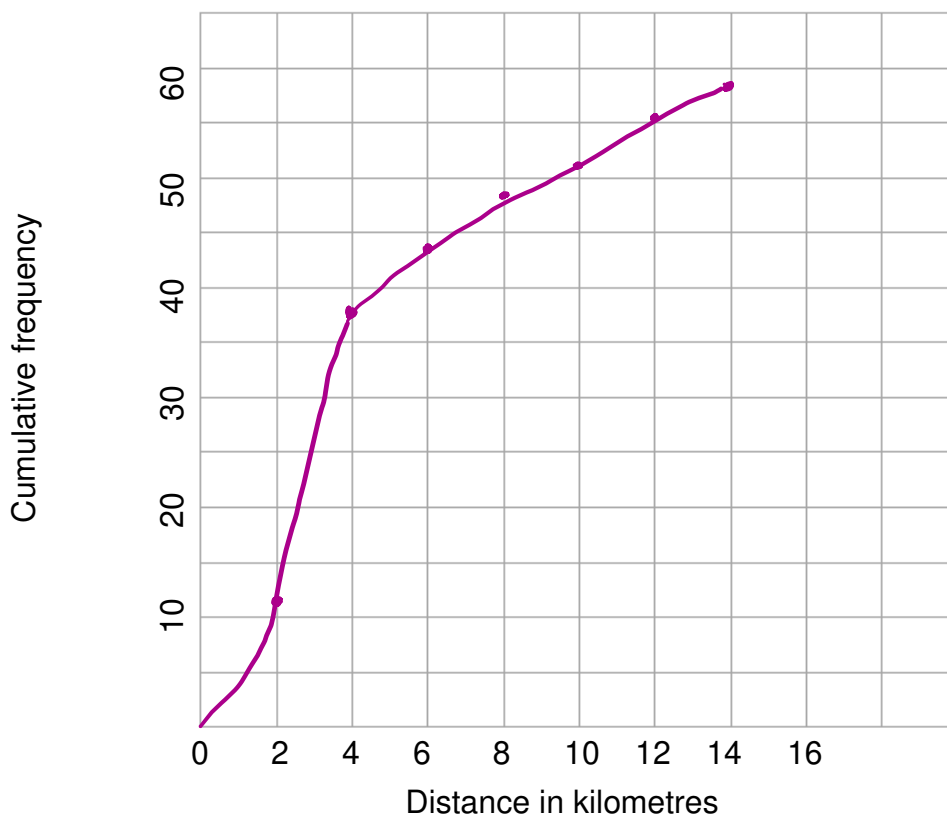
8 Marks

The fitness instructor on the boat recorded the distances that athletes ran on the boat on the different courses set out.

Kilometres ran	Cumulative frequency
$0 < x \leq 2$	12
$2 < x \leq 4$	38
$4 < x \leq 6$	44
$6 < x \leq 8$	49
$8 < x \leq 10$	52
$10 < x \leq 12$	56
$12 < x \leq 14$	58



- (a) Draw an ogive that represents the data above on the given grid. (3)



freehand

✓ grounding
 ✓ endpoints
 ✓ curve

- (b) Calculate the estimated average that these athletes ran. Show calculations. (2)

$$\begin{aligned}\bar{x} &= \frac{252}{58} \quad \checkmark \text{ m} \\ &= \underline{4,3 \text{ km}} \quad \checkmark \text{ a}\end{aligned}$$

Use frequency and not cf.
Know the formula

- (c) What percentage of athletes ran between 4 and 12 km per day? (2)

$\checkmark \text{ a} \left\{ \begin{array}{l} 18 \\ 58 \end{array} \right\} \times 100\% = 31\% \quad \checkmark \text{ ca from their table if they used freq}$

56-38 or add the frequencies

- (d) An athlete claimed that the interquartile range is a better measure of spread for the data set, than the range. Which of the following is the better reason for the statement?

- $\checkmark \text{ a}$ (1) (1) More than 50 % of the data lies in the interval $0 < x \leq 4$ km.
(2) The mean for the data is 3,7 km.
 $\rightarrow$ Spread of data does not include mean.
Circle the one you choose. (1)

Question 14

7 Marks

On a ship, the tides can create the up and down movement on the sea. During a certain time period, the tides cause the water level to rise and fall from the average water level. This scenario can be modelled by $y = 6 \cos(30x)$, where y represented the distance in metres of the rise and fall and x the number of hours.

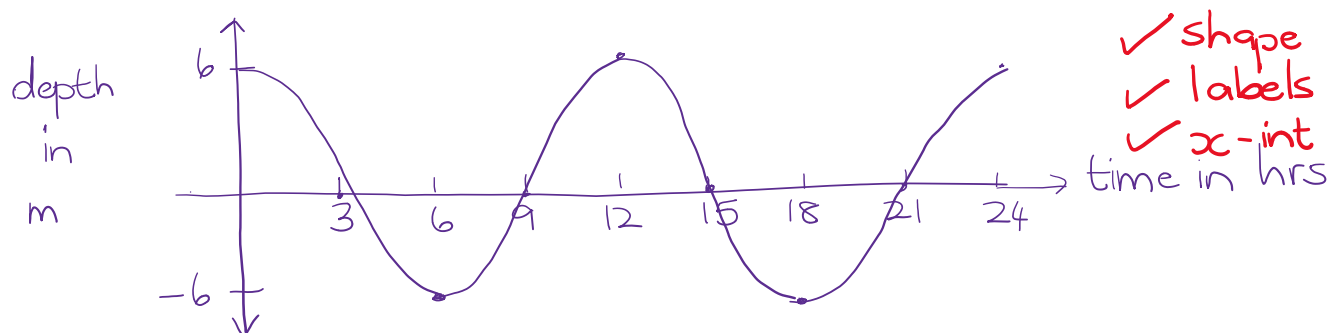
- (a) What is the maximum height that the boat will rise above the average sea level? (1)

6m ✓ a

- (b) According to the model, what is the period of the rise and fall? (1)

12 hrs ✓ a

- (c) Sketch a graph for the first $x \in [0;24]$ hours, label the axes and indicate all relevant points. (3)



- (d) If this model starts at 12h00 midnight, at what time will the boat first reach a minimum depth? (1)

6 am ✓ ca from graph

- (e) If the minimum depth of the water at low tide changes to 2 meters, how would the equation change given the rise and fall distance remains the same? (1)

$$y = 6 \cos(30x) + 4 \quad \checkmark a$$

SUB-TOTAL SECTION B: 77

TOTAL: 150

ADDITIONAL WORKING SPACE