ST. DAVID'S MARIST INANDA

MATHEMATICS
PRELIMINARY EXAMINATION
PAPER 2

GRADE 12
13 September 2017

EXAMINER: MRS S RICHARD	**MARKS: 150**
MODERATOR: MRS C KENNEDY	**TIME: 3 hours**

NAME:_____

PLEASE PUT A CROSS NEXT TO YOUR TEACHER'S NAME:

| Mrs Kennedy	Mrs Nagy	Mr Vicente	Mrs Richard	Mrs Black

INSTRUCTIONS:

- ✓ This paper consists of 24 pages and a separate 2 page information sheet. Please check that your paper is complete.
- ✓ Please answer all questions on the Question Paper.
- ✓ You may use an approved non-programmable, non-graphics calculator unless otherwise stated.
- ✓ It is in your interest to show all your working details and give valid reasons where necessary.
- ✓ Reasons for all Geometry must be clearly stated.
- ✓ Work neatly. Do NOT answer in pencil.
- ✓ Diagrams are not drawn to scale.

SECTION A	Q1 [17]	Q2 [21]	Q3 [19]	Q4 [9]	Q5 [9]	SUB-TOTAL [75]		
LEARNER'S MARKS								
SECTION B	Q6 [13]	Q7 [11]	Q8 [13]	Q9 [19]	Q10 [4]	Q11 [10]	Q12 [5]	SUB-TOTAL [75]
LEARNER'S MARKS								

SECTION A

QUESTION 1

In the diagram below, $A(-2; 6), B(8; -4)$ and $C(-6; k)$ are three points in the Cartesian plane with point M the midpoint of AB and $AB = BC$.
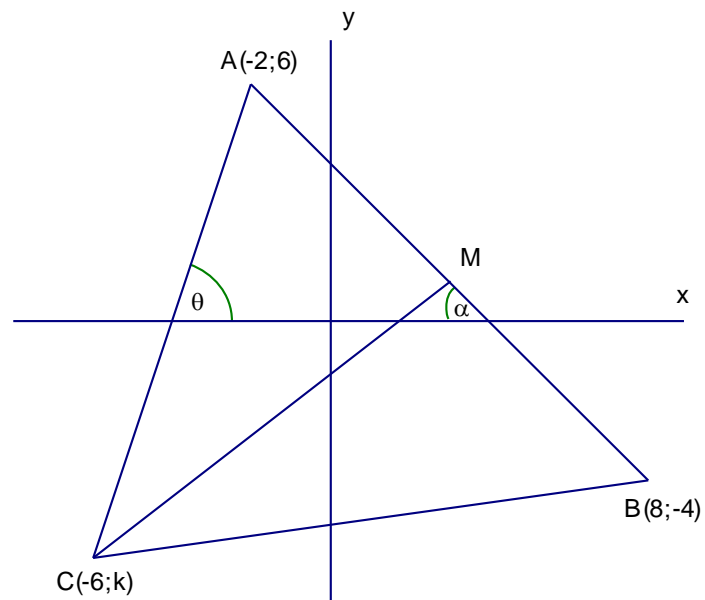
a) Determine the coordinates of M. (2)

b) Determine the value(s) of k. (6)

c) Hence, determine the equation of the line CM if $k = -6$. (3)

d) Determine the value of:

   i) θ if $k = -6$ (2)

   ii) α

(2)

   iii) $C\hat{A}B$ (2)

[17]

QUESTION 2

a) Show that

$$\frac{\sin(90° + x).\cos x.\tan(-x).\sin(x - 180°)}{\cos(180° + x).\sin(540° + x)} = \sin x$$

(6)

b) i) Given: $\quad \sin x = \cos 2x - 1$

Show that $2\sin^2 x + \sin x = 0$ (1)

ii) Determine the general solution of $\sin x = \cos 2x - 1$ (6)

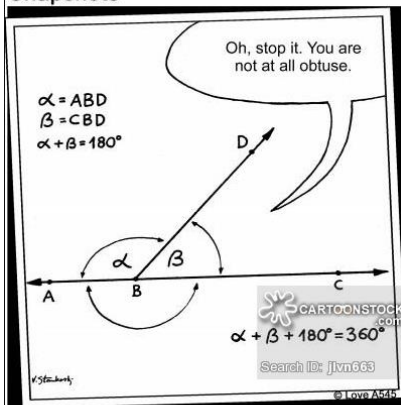c) If $sin28° = a$ and $cos32° = b$, determine the following in terms of a and b.

    i) $cos28°$ (2)

    ii) $cos64°$ (2)

    iii) $sin4°$ (4)

[21]

Snapshots

α = ABD
β = CBD
$\alpha + \beta = 180°$

Oh, stop it. You are not at all obtuse.

$\alpha + \beta + 180° = 360°$
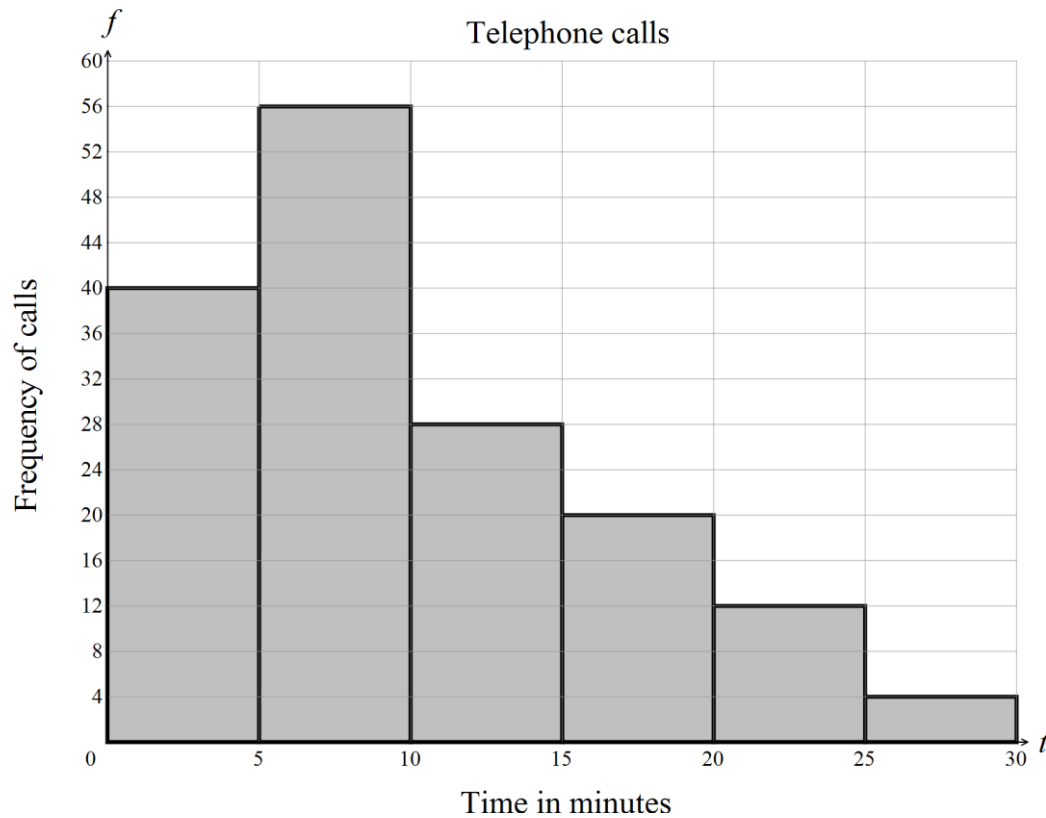
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Complimentary angles make the other angles feel good about themselves.

QUESTION 3

Telephone calls
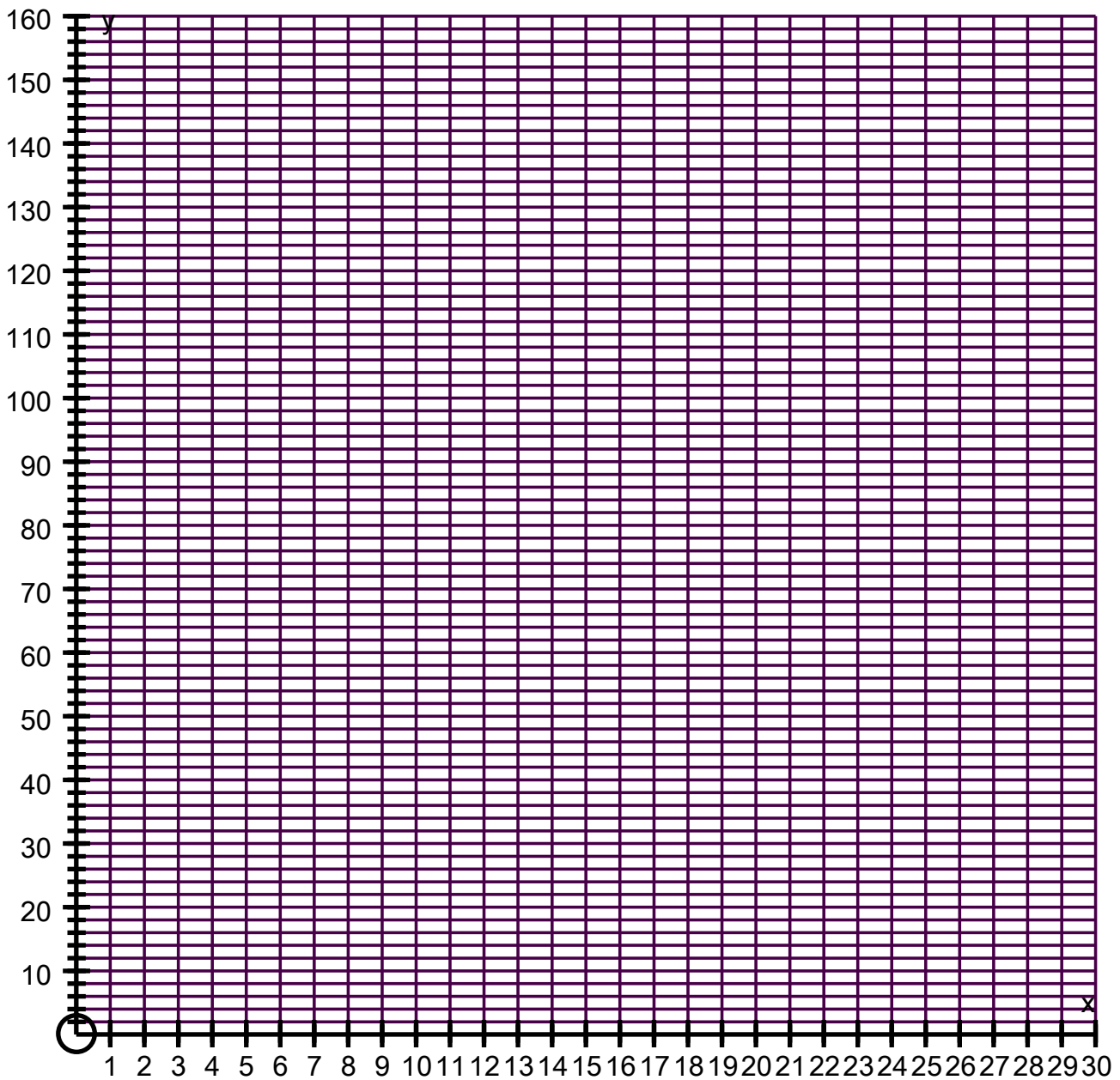
The diagram above shows a histogram for the lengths of telephone calls.

a)   **Complete the frequency table for the data.**   (3)

Time in minutes	Frequency	Class midpoint	Cumulative frequency
$0 \leq x < 5$	**40**	**2.5**	**40**
$5 \leq x < 10$			
$10 \leq x < 15$			
$15 \leq x < 20$			
$20 \leq x < 25$			
$25 \leq x < 30$			

b) Draw an ogive (cumulative frequency curve) to illustrate the data. (3)

c) Use your ogive (cumulative frequency curve) to answer the questions below:

i) State the median length of a phone call. (1)

ii) What is the interquartile range? (3)

iii) What percentage of phone calls last for 20 minutes or longer? (2)

d) Use the frequency distribution associated with your histogram to estimate

   i) the mean length of a call. (2)

   ii) the standard deviation of a call. (2)

e) Use your ogive and the your answer to d)ii) to determine the number of calls which lie within one standard deviation of the mean. (3)

[19]
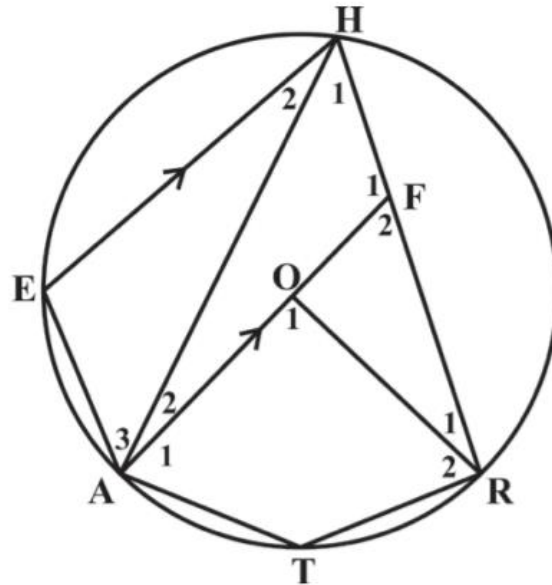
QUESTION 4

In the diagram O is the centre of the circle HEATR. AOF is parallel to EH.

$\hat{F}_2 = 78°$ and $\hat{R}_1 = 22°$

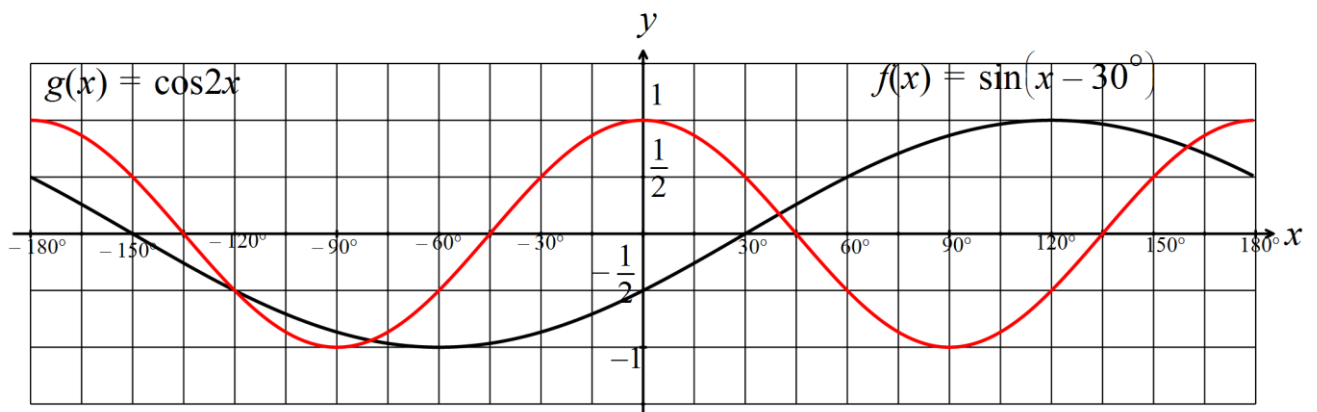Calculate, with reasons, the size of:

a) $\hat{O}_1$ (2)

b) $\hat{H}_1$ (2)

c) $\hat{T}$ (2)

d) $\hat{H}_2$ (3)

[9]

QUESTION 5

The graph shows the curves of:

$f(x) = \sin(x - 30^0)$ and $g(x) = \cos 2x$ for $x \in [-180^0; 180^0]$

Answer the following questions with the aid of the graph.

a)   What is the period of the graph of $g(\frac{1}{4}x)$?   (1)

b)   State the amplitude of the graph of h if $h(x) = \frac{g(x)}{2}$.   (1)

c)   How many solutions does the equation:
       $\sin(x - 30^0) = \cos 2x$ have if $x \in [-180^0; 180^0]$?   (1)

d) For which value(s) of *x* is $\cos^2 x = \sin^2 x$ if $x \in [0^0; 180^0]$?

(show how the graph above can be used to answer this question)

(3)

e) For which value(s) of x is $2\cos 2x.\sin(x - 30^0) \geq 0$ if $x \in [0^0; 180^0]$?

(3)

[9]

[Total Section A: 75 marks]

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"I find if you put that slash through the equal sign,
the number of possible answers vastly increases."
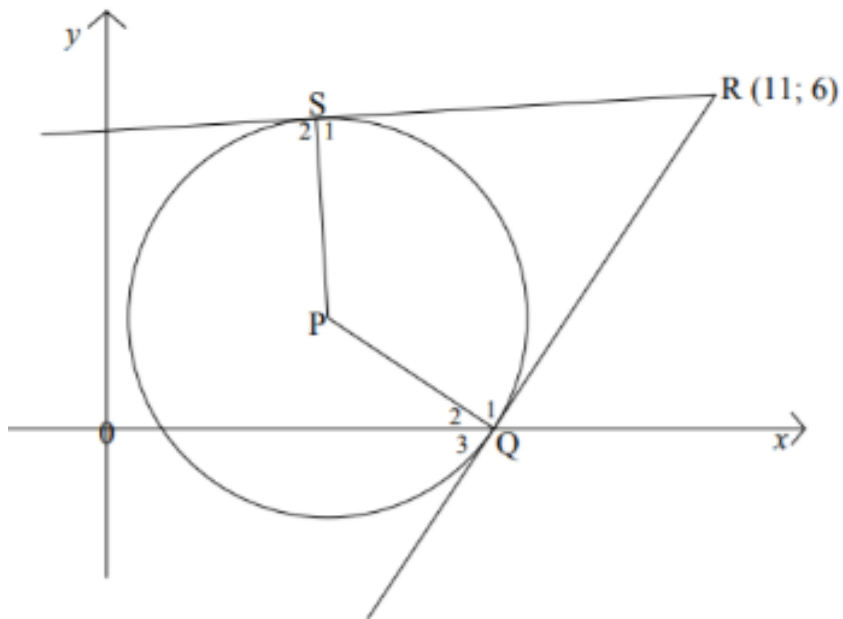
SECTION B

QUESTION 6

A circle centre P and radius PQ is sketched with Q on the x-axis.

QR and SR are tangents to the circle at Q and S respectively, intersecting at R(11;6)
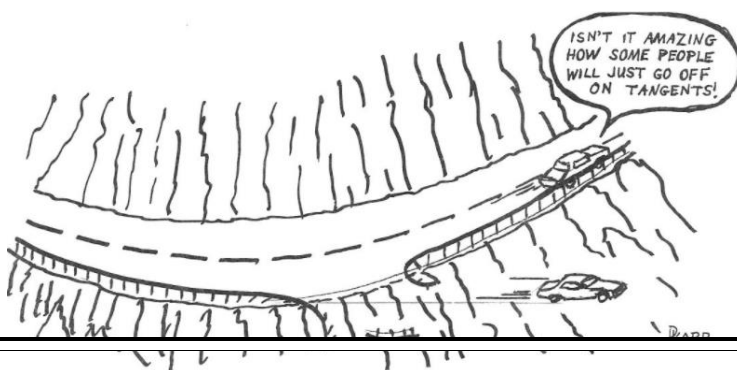

a) If the circle defined by $x^2 - 8x + y^2 - 4y = -7$, determine the coordinates of the centre P, and the length of the radius PQ, leaving your answers in surd form. (4)

b) Prove that the quadrilateral PQRS is cyclic, stating reasons. (4)

c) Determine the length of RS, leaving your answer in surd form.   (5)

[13]

QUESTION 7

A hot-air balloon H is directly above point B on the ground. Two ropes are used to keep the hot-air balloon in position. The ropes are held by two people on the ground at point C and point D. B,C and D are in the same horizontal plane. The angle of elevation from C to H is x. $C\hat{D}B = 2x$ and $C\hat{B}D = 90° - x$. The distance between C and D is k metres.
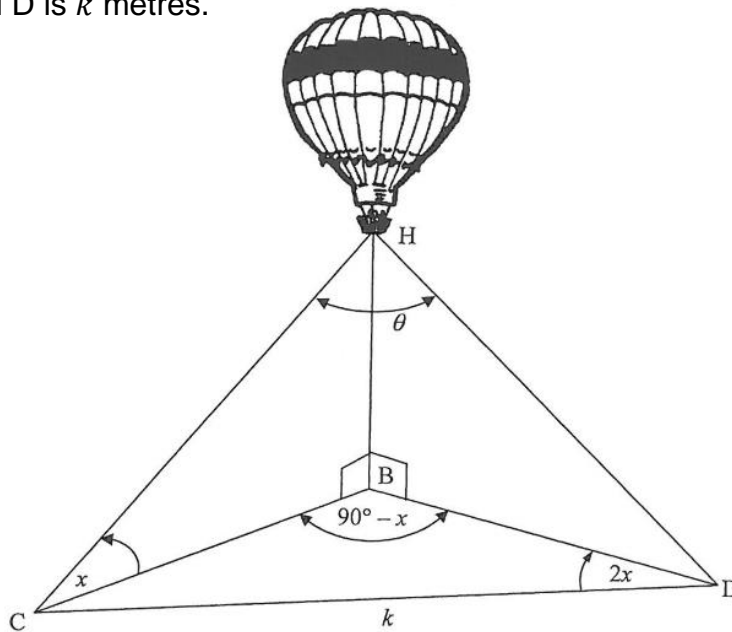
a) Show that $CB = 2k\ sinx$. (4)

b) Hence, show that the length of rope HC is $2k\ tanx$. (3)

c) If $k = 40m, x = 23°\ and\ HD = 31,8\ m$, calculate $\theta,$ the angle between the two ropes, to 2 decimal places. (4)
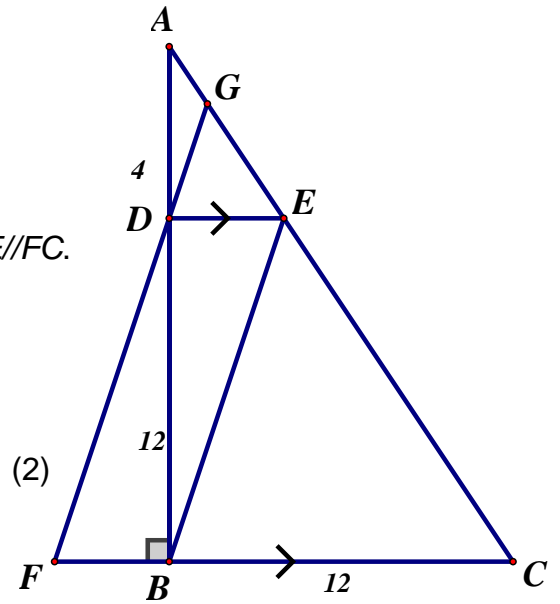
[11]

QUESTION 8

Refer to the diagram (not drawn to scale):

In the diagram $\triangle ABC$ is a right-angled triangle.

The point D lies on AB and E lies on AC such that $DE/\!/FC$.

BC = 12 units, AD = 4 units and DB = 12 units.

a)   Show that AC = 20 units   (2)

b)   Calculate, stating reasons, the size of:

1) AE (3)

2) EC (1)

c)   It is further given that: $GE = 3\dfrac{3}{4}$ units.

  i)   Determine the length of DE.   (3)

  ii)   Hence, or otherwise, prove that DEBF is a parallelogram.   (4)

[13]

"So, for every day that your math grade stays below a B, your father will post a video of himself on YouTube."

QUESTION 9

a)   Complete the statement:

A line parallel to one side of triangle …….   (2)
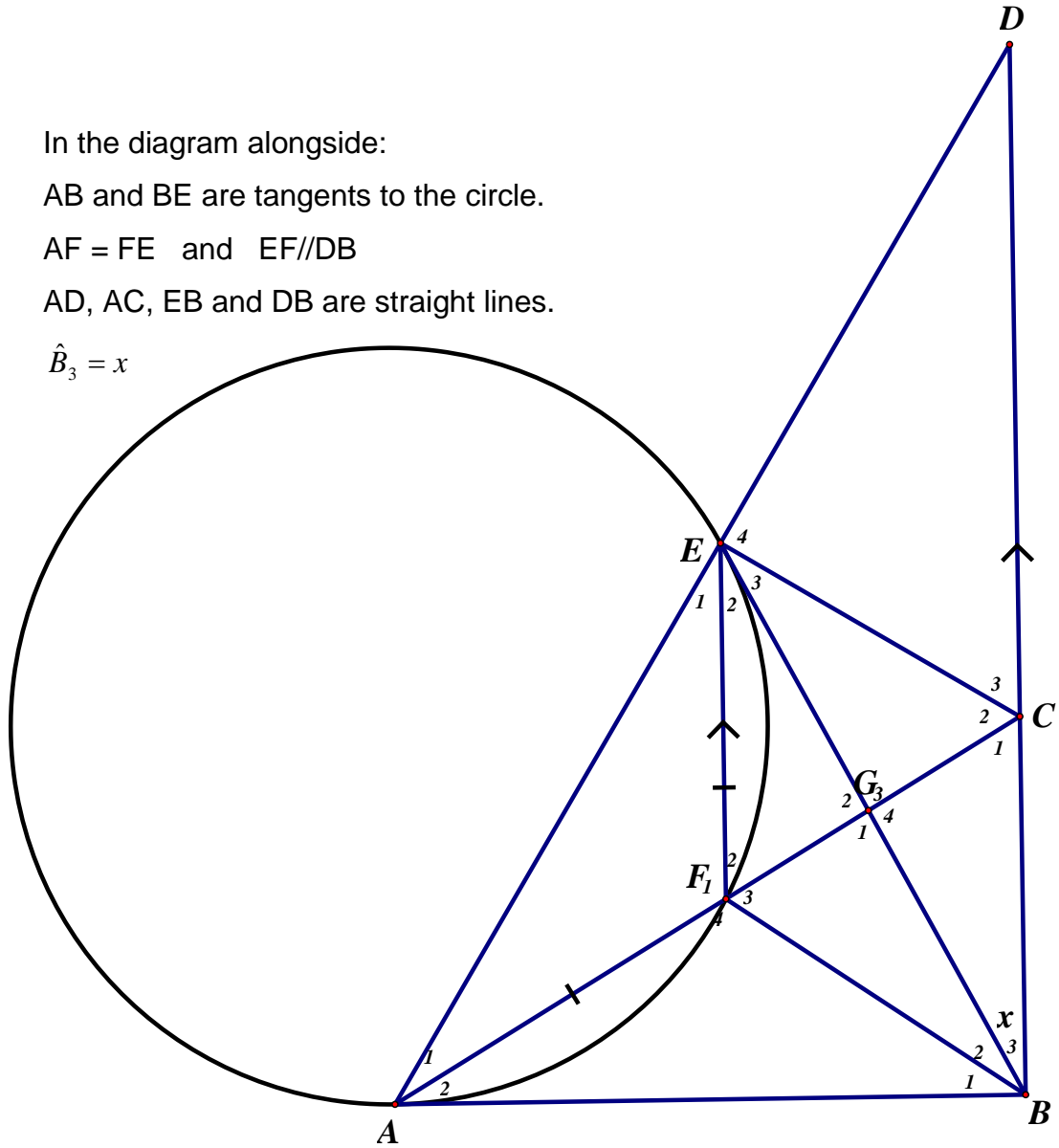
b)   In the diagram alongside:

AB and BE are tangents to the circle.

AF = FE   and   EF//DB

AD, AC, EB and DB are straight lines.

$\hat{B}_3 = x$

i)   Complete: $\dfrac{AF}{FC} = ...$ (1)

ii)   With reasons, write down 5 other angles equal to *x*.   (5)

iii)   Prove that AECB is a cyclic quadrilateral.   (2)

iv)   Prove that $\Delta ACB \; /// \; \Delta DAB$ (3)

v)   Hence, deduce that $AB^2 = DB.CB$ (2)

vi)   Is EC a tangent to the circle passing through E, G and A? Give a
        reason.   (4)

[19]

QUESTION 10

If $sinB + cosB = 1,2$, evaluate, **without using a calculator** $sinBcosB$.   (4)

[4]

QUESTION 11

The Metropolitan Cathedral in Rio de Janeiro is a conical frustrum with height 75m, base diameter 105m and top diameter 35m.
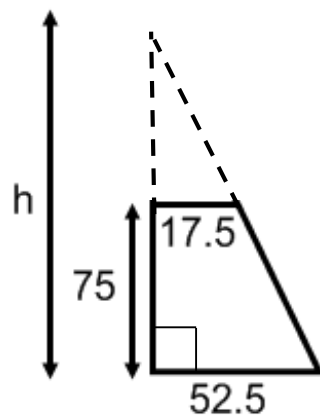

Formulas you may need:

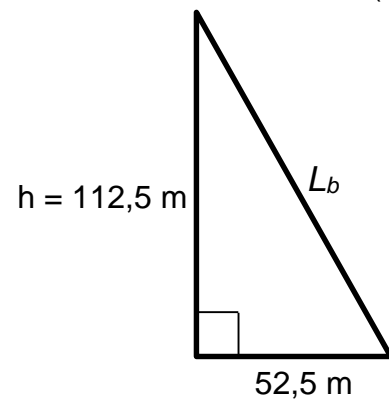$$V = \frac{1}{3}\pi r^2 h$$

$$SA = \pi r l + \pi r^2$$

The diagram below shows the longitudinal cross-section of the building:

a) Show that h = 112,5m   (3)

b) Calculate the slant length of the large cone, L_b, in metres. Leave your answer in surd form. (3)

h = 112,5 m

L_b

52,5 m

c) If the slant length of the smaller cone (that has been removed), $l_s = \sqrt{1712{,}5}$ m, calculate the surface area of the frustum-shaped building in m^2 (do <u>not</u> include the circular base or roof of the building). (4)

h − 75

l_s

17,5 m

[10]
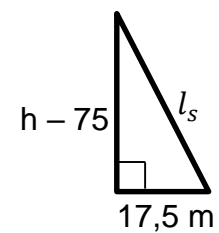
QUESTION 12

Four circular coins of unequal sizes lie on a table so that each coin touches two, and only two, of the others. Prove that the four points of contact, ABCD are concyclic. (5)
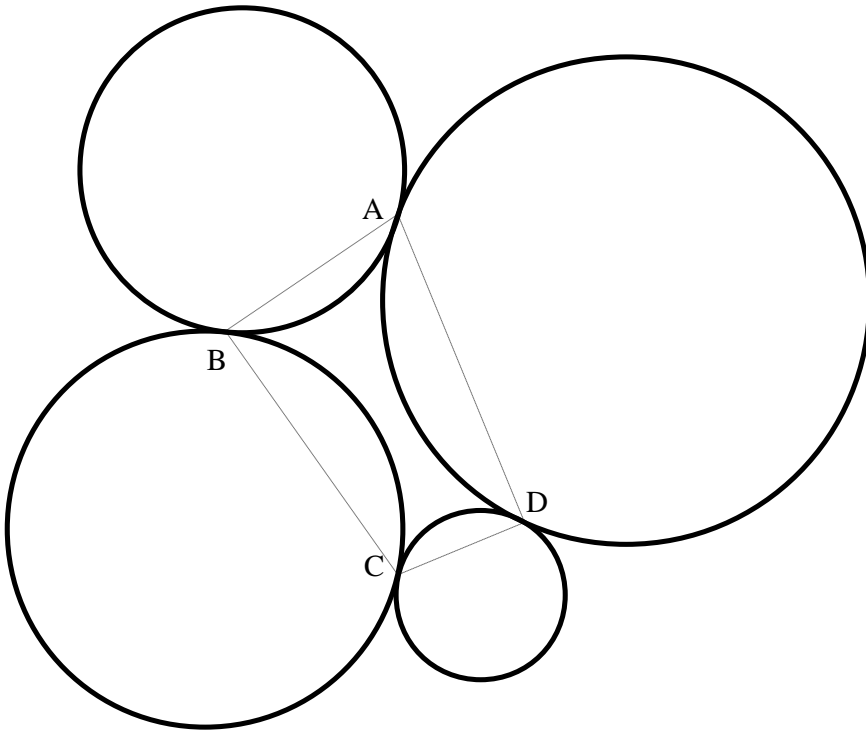
[5]

[Total Section B: 75 marks]

[Total: 150 marks]