

In the figure, A(-3;4), P(5;6), Q(3;3), R(4;-2) and  $S(4\frac{1}{2};2)$  are given.

AOPT is a parallelogram.

- a) Determine the perimeter of  $\triangle AQP$ . Give your answer correct to one decimal digit.

(4)

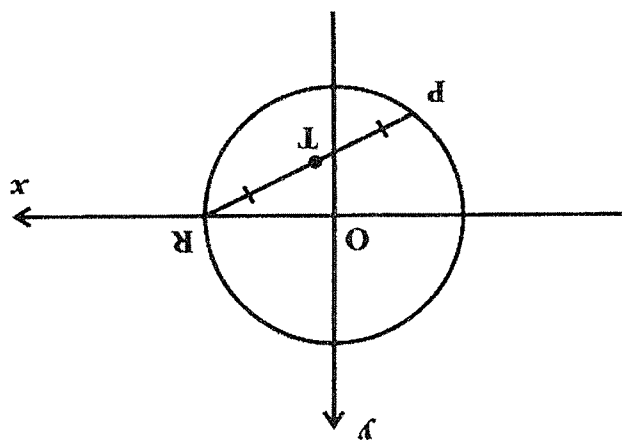
[12 MARKS]

c) Determine the midpoint of AR and hence or otherwise determine the coordinates of T. (5)

b) Show that P, S and R are collinear. (3)

**QUESTION 2**

In the diagram below, a circle with equation  $x^2 + y^2 = r^2$  is drawn. T (4;-6) is the midpoint of PR. R is a point on the  $x$ -axis.



a) Write down the size of  $\angle ORT$  giving reasons. (2)

b) Show that the equation of PR is  $3y = 2x - 26$  (3)

c) Determine the radius of the circle. (3)

**[8 MARKS]**

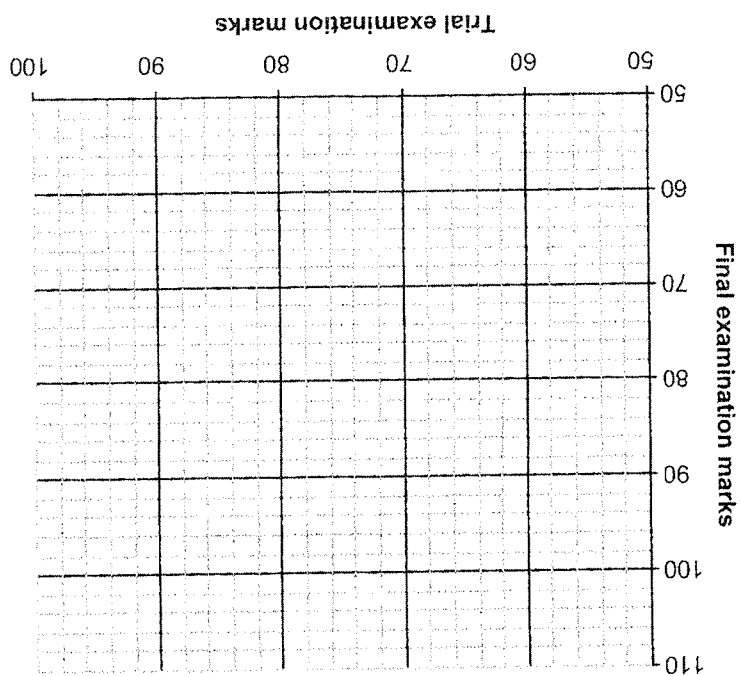
**QUESTION 3**

The data below shows the marks of the Grade 12 preliminary examination and the corresponding final examination, for 11 students.

Prelim Examination marks	Final Examination mark
80	72
68	71
94	96
72	77
74	82
83	72
56	58
68	83
65	78
75	80
88	92

a) Draw a scatter plot of the above data on the grid provided. (3)

Scatter plot showing the trial examination marks vs. the final examination mark



b) Find the equation of the best fit line for the Final examination mark ( $y$ ) against the Prelim examination mark ( $x$ ) in the form  $y = a + bx$ . Determine the values of  $a$  and  $b$  rounded to two decimal digits. (3)

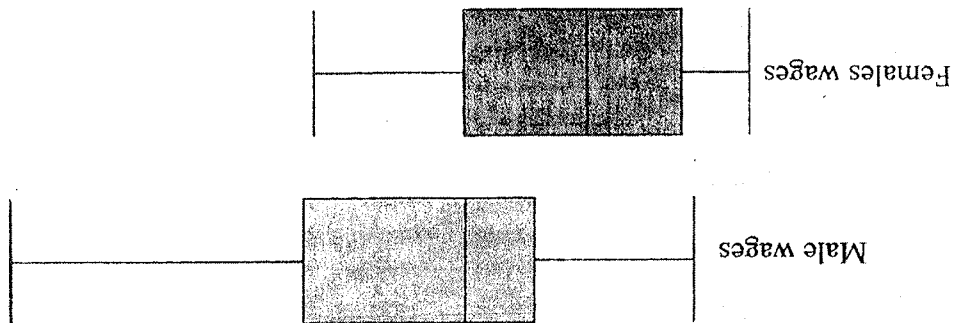
- c) Sketch the line of best fit on the the same set of axes. (3)
- d) Calculate the correlation coefficient for the above data. What does it tell you about the students prelim and final examinations. (3)

- e) What will the predicted final examination mark be for a learner averaging 50 in the trial examination. (2)

[14 MARKS]

**QUESTION 4**

The box and whisker plots show the wages for men and women for the same type of work



200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150

State whether each of the following statements are true or false.

a) 75% of the females earn less than 50% of the males.

(1)  True  False

b) Both distributions are positively skewed.

(1)  True  False

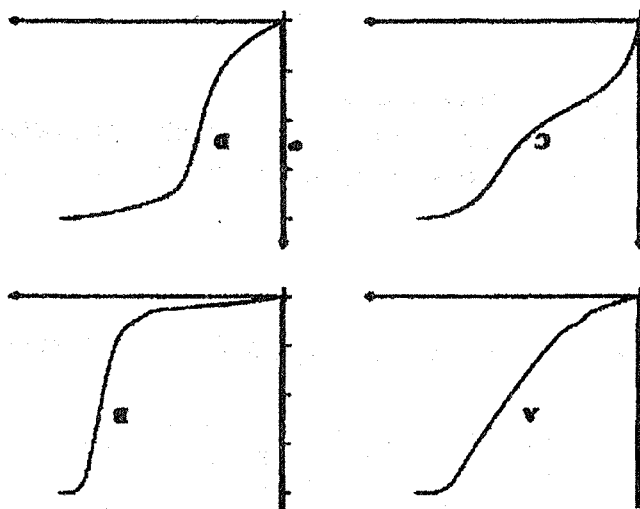
c) The highest paid male earns approximately 30% more than the highest paid female

(1)  True  False

[3 MARKS]

**QUESTION 5**

a) Four cumulative frequency diagrams are given below:



Which one of the diagrams best fits the box and whisker diagram given below?

Write only the letter next to the box and whisker.



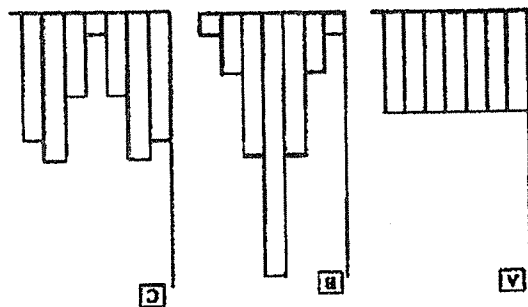
b) The following information summarises the year marks for a class of 20 students.

$$\sum_{i=1}^{20} (x_i - \bar{x})^2 = 1560 \quad \sum_{i=1}^{20} x_i = 1220$$

i) Determine the mean mark for the class. (2)

ii) Determine the standard deviation for the class. (3)

c) Three populations A, B and C are the same size and have the same range. Frequency histograms for the three populations are given below. Which population (A, B, C or none of them) has a standard deviation of zero.



(1)

[8 MARKS]

QUESTION 6

If  $\sin 61^\circ = \sqrt{d}$  determine the following in terms of  $d$ .

a)  $\sin 241^\circ$  (2)

b)  $\cos 61^\circ$  (2)

c)  $\cos 73^\circ \cos 44^\circ + \sin 73^\circ \sin 44^\circ$  (3)



i)  $\sin 75^\circ \cos 15^\circ - \cos 75^\circ \sin 15^\circ$  (2)

a) Find the values of the following, without the use of a calculator, leaving your answers in surd form where necessary.

QUESTION 7

[12 MARKS]

d) Prove the identity  $\frac{\cos 2x - 1}{\sin 2x} - \tan x = -2 \tan x$  (5)

(6) Find the value of  $\sin^2(\alpha + \beta)$

$\tan \alpha = \frac{4}{3}$  and  $\tan \beta = 7$  where  $\alpha$  and  $\beta$  are acute angles

b) Given:

(3) ii)  $\sin^2 260^\circ + \sin^2 10^\circ$

[17 MARKS]

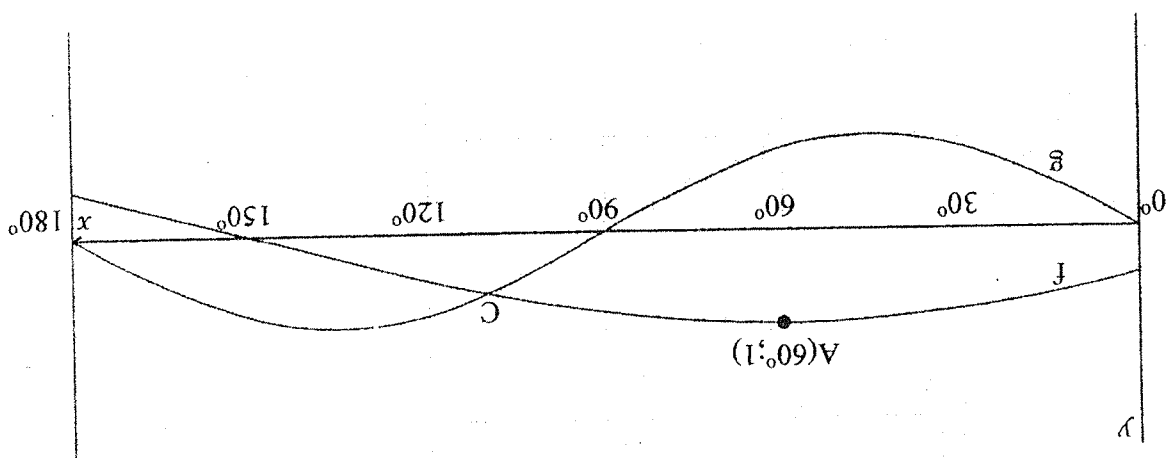
(6)

$$2 \tan(2\theta - 12^\circ) = 0,936$$

c) Find the general solution of the following equation:

**QUESTION 8**

The figure shows the graph of  $f(x) = \cos(x + \theta)$  and  $g(x) = -\sin 2x$  for  $x \in [0^\circ; 180^\circ]$   
 A is  $(60^\circ; 1)$



a) Write down the range of  $g$ . (1)

b) Determine the value of  $\theta$ . (2)

c) C  $(x; y)$  is the point of intersection of the two graphs. Solve for  $x$ . (7)

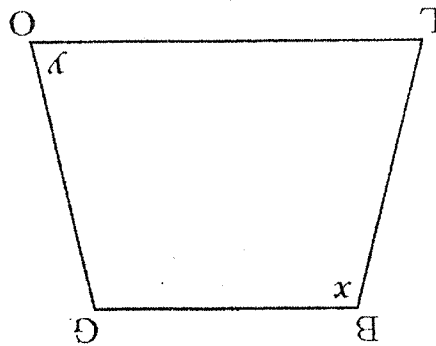
[12 MARKS]

d) For which values of  $x$  is  $f(x) \cdot g(x) > 0$ ? (2)

**SECTION B**

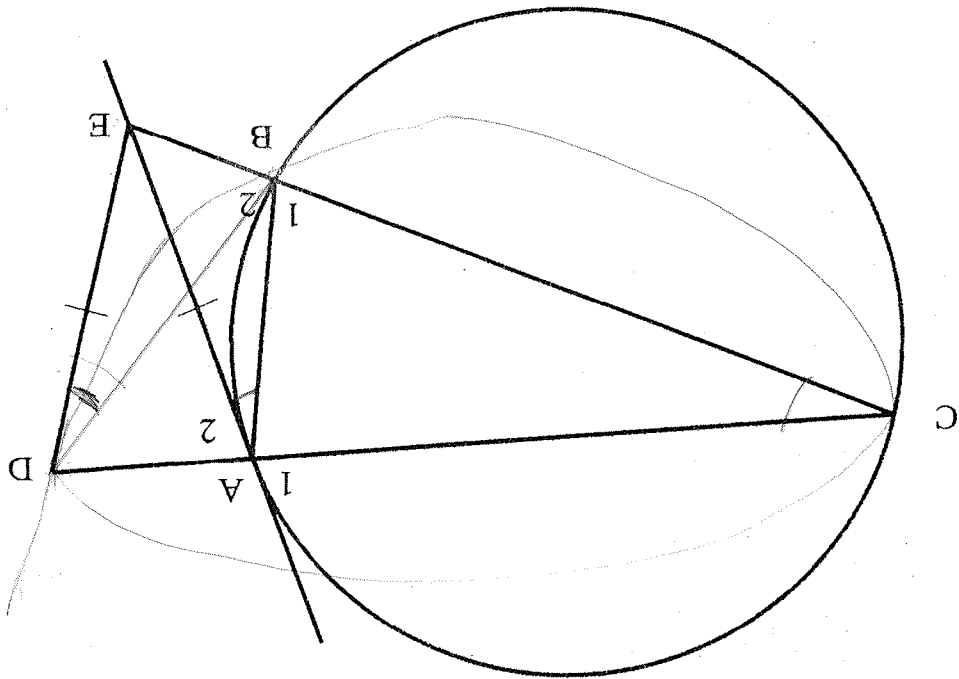
**QUESTION 9**

In quadrilateral  $BLOG$  if  $x + y = 180^\circ$ , then  $BLOG$  is a cyclic quadrilateral.



- a) Give two more conditions for a quadrilateral to be cyclic. Illustrate each of your answers with a suitable sketch for explanation.
- (4)

- (5) i) Prove that  $ABED$  is a cyclic quadrilateral.  
 In circle  $ABC$ ,  $CA$  is extended to  $D$  and  $CB$  is extended to  $E$ .  
 $AE$  is a tangent to the circle at  $A$ .  $AE = DE$ .



b)

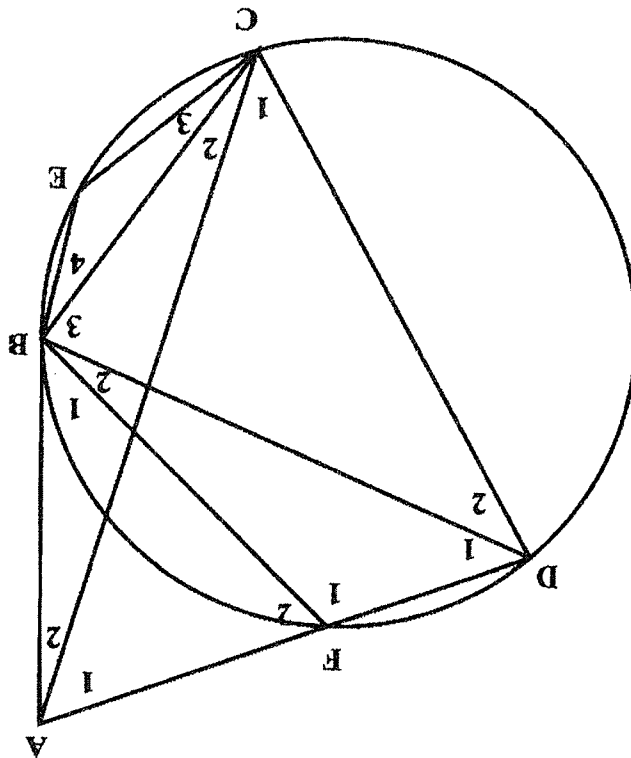
[13 MARKS]

ii) Join BD and prove that DE is a tangent to the circle CBD. (4)



**QUESTION 10**

In the diagram below, AB is a tangent to the circle passing through B, E, C and D. AD cuts the circle at F. AC is drawn.



A list of statements is given. Give reasons for the statements that are correct. If a statement is not necessarily correct, write 'not correct' in the space provided for the reason.

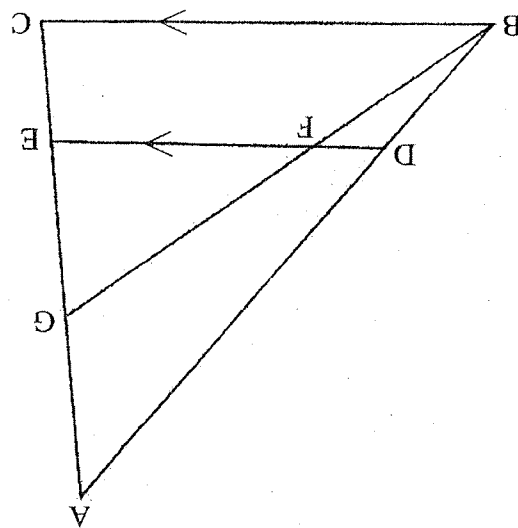
STATEMENT	REASON
$\angle C_1 + \angle C_2 = \angle F_2$	
$\angle D_2 + \angle E = 180^\circ$	
$\angle B_1 = \angle D_1$	
$\angle B_1 + \angle B_2 = \angle D_1 + \angle D_2$	
$\angle D_2 = \angle A_2$	

(5)

[5 MARKS]

QUESTION 11

In the triangle ABC, G is the midpoint of AE, DE is parallel to BC and BG intersects DE at F.



a) Explain why  $\frac{AD}{DB} = \frac{AE}{EC}$  and  $\frac{GE}{GF} = \frac{FB}{FD}$

(2)

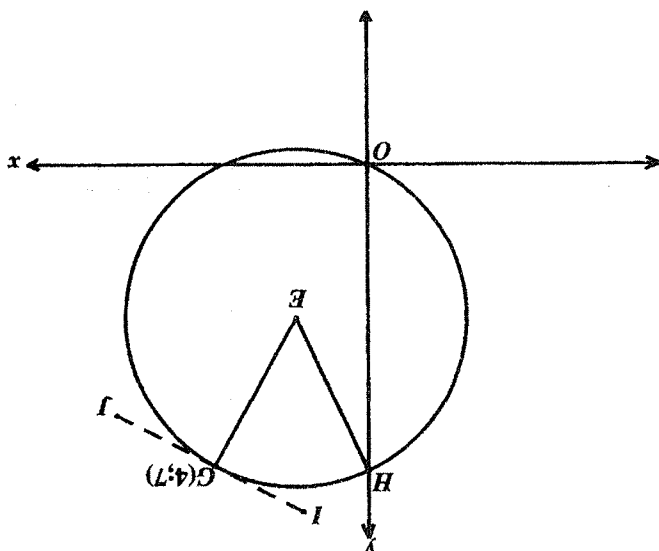
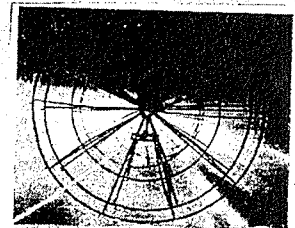
b) If  $\frac{AD}{DB} = \frac{1}{4}$ , determine the value of  $\frac{GF}{FB}$

(3)

[5 MARKS]

**QUESTION 12**

The following picture is represented on the figure below. The centre is represented by the letter E, H is the y - intercept of the circle and the x - intercept is at the origin O.



a) Determine the centre (E) and radius, (correct to one decimal digit) of the circle, if its equation is:  $x^2 - 4x + y^2 - 7y = 0$

(4)

b) Determine the coordinate H.

(3)

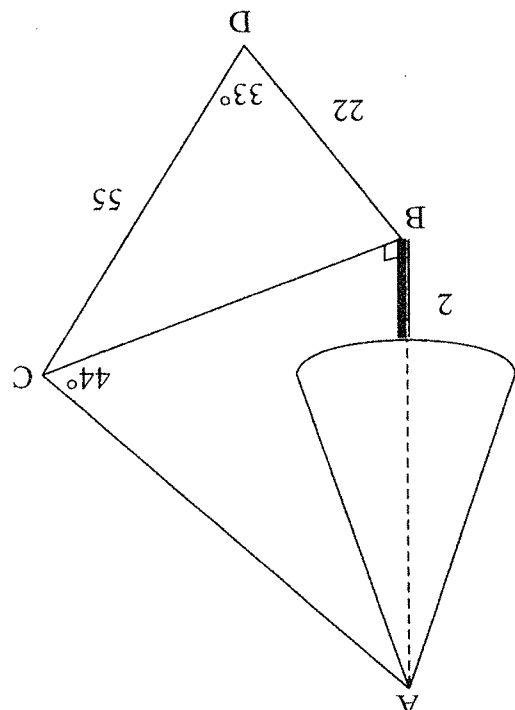
[16 MARKS]

d) If  $l$  is the tangent to the circle at  $G(4; 7)$ , determine the equation of this tangent. (5)

c) Calculate  $\hat{EHO}$  correct to one decimal digit. (4)

**QUESTION 13**

In the diagram below, a tall tree is roughly illustrated by a right cone. The centre of the circular base of the cone is 2 metres above a point, B, on the horizontal ground.



D and C are points in the same horizontal plane as B so that  $BD = 22\text{metres}$ ,  $DC = 55\text{metres}$  and  $\hat{BDC} = 33^\circ$ . The angle of elevation of the top of the tree, A, from C is  $44^\circ$

a) Find the height AB of the tree, correct to two decimal places. (6)

- b) If the radius of the base of the cone is 3 metres, find the volume of the cone depicting the foliage of the tree in the diagram above.  
 The volume of the cone is given by:

$$\frac{\text{base area} \times \text{height}}{3}$$

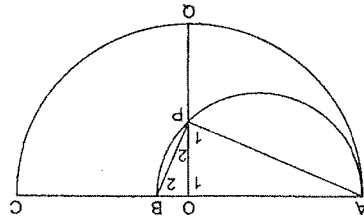
(4)

**QUESTION 14**

Two semi-circles touch each other at A. QP produced cuts AB at O, the centre of the larger semi-circle, such that  $\widehat{QO} \perp AB$

Prove that  $OP^2 = OA \cdot OB$

(6)



QUESTION 15

Study the following true statements and then answer the questions that follow

$$\frac{1 - \cos 10^\circ}{1 + \cos 10^\circ} = \tan 5^\circ \times \tan 185^\circ$$

$$\frac{1 - \cos 20^\circ}{1 + \cos 20^\circ} = \tan 10^\circ \times \tan 190^\circ$$

$$\frac{1 - \cos 30^\circ}{1 + \cos 30^\circ} = \tan 15^\circ \times \tan 195^\circ$$

$$\frac{1 - \cos 80^\circ}{1 + \cos 80^\circ} = \tan 40^\circ \times \tan 220^\circ$$

$$\frac{1 - \cos 100^\circ}{1 + \cos 100^\circ} = \tan 50^\circ \times \tan 230^\circ$$

a) Write down a possible value for P and a possible value for Q if

$$\frac{1 - \cos 60^\circ}{1 + \cos 60^\circ} = \tan P \times \tan Q$$

(2)

[9 MARKS]

c) Prove the conjecture in b. (5)

only:  $\frac{1 - \cos 2A}{1 + \cos 2A} = \tan(\dots) \times \tan(\dots)$  (2)

b) Formulate a conjecture by completing the following statement in terms of A