

EXAMINER: MRS J L WARREN

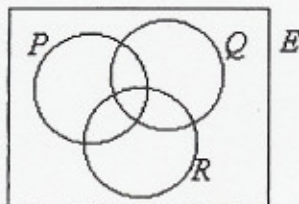
Students are requested in their own interests, to write legibly and in pen.

**PLEASE NOTE:** This question paper consists of 6 pages.  
Please see that you have them all.

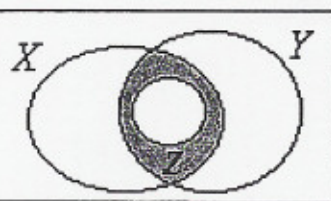
Answer all questions and show all working.

**Question 1:**

- a) If  $A$  is any set, what is:
- (i)  $A \cap A$  (ii)  $\emptyset \cap A$  (iii)  $\emptyset \cup A$  (1,5)
- b) If  $X = \{3; 5; 7; 9\}$  and  $Y$  is the set of odd numbers between 2 and 10, what is the relationship between  $X$  and  $Y$ ? (1)
- c)  $A$  is the set of all subjects included in the Science Foundation Programme.  
 $B$  is the set of SFP subjects which require laboratory work.  
 $C$  is the set of all subjects offered at the University of KwaZulu-Natal.
- (i) Which of the above three sets can be considered to be the universal set for this question?
- (ii) Draw a Venn diagram showing  $A, B$  and  $C$ . Show all elements of  $A$  and  $B$  and some elements of  $C$ .
- (iii) Find  $n(A \cap B')$ . (4)
- d) (i) Copy the diagram alongside, and on it shade  $P \cup Q'$ .



(3)

(2,5)  
[12]

## Question 2:

a) Show on separate number lines:

(i) Composite numbers between 1 and 10.

(ii) Real numbers greater than  $-1\frac{1}{2}$  and less than or equal to 7. (2,5)

b) From the list of numbers below:

$$\sqrt{2}; 1,38427; \frac{16}{0}; \sqrt{-9}; \sqrt{16}; \frac{121}{11}$$

pick out all those which are:

(i) rational

(ii) positive

(iii) prime

(iv) irrational

(v) non-real. (5)

c) (i) If  $p$  is any integer, give an odd integer in terms of  $p$ .

(ii) Show that the product of 2 different odd integers is odd. (5,5)

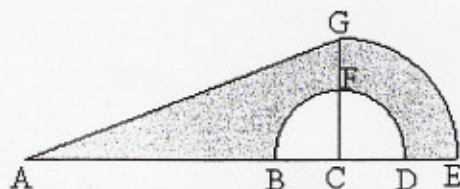
[13]

## Question 3:

a) In the diagram alongside, arc BFD is a semicircle and arc GE is a quarter circle.

 $AB = s$  mm $BC = CD = DE = CF = FG = t$  mm

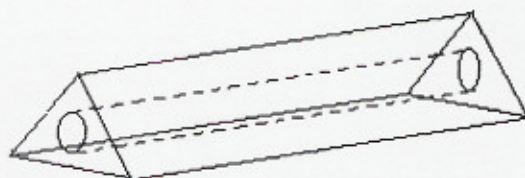
Find the area of the shaded part.



(6)

b) A goat is tied by a 6 metre rope to the outside corner of a rectangular building measuring 4 m by 5 m, in a grassy field. What is the **perimeter** of the grass that the goat can graze?Give your answer in terms of  $\pi$ .

(8,5)

c) The triangular prism shown below has an equilateral triangle of side  $2a$  units as its base. The length of the prism is three times the side of the triangle.A circular hole, radius  $\frac{a}{2}$  units, is drilled through the length of the prism.(i) Find the volume of the prism shown above in terms of  $\pi$  and  $a$ . (7)(ii) Find the total surface area of the prism in terms of  $\pi$  and  $a$ . (7,5)(iii) If all the measurements of this prism are multiplied by  $p$ :

(I) What will the volume be multiplied by?

(II) What will the total surface area be multiplied by? (2)

[31]



## Question 4:

- a) After 4 hours of travelling at 100 km/h, a man increases his speed to 120 km/h for the rest of his journey. If the whole journey takes 6 hours, what was the total distance travelled? (3,5)
- b) The strength of an average wooden plank depends on its length, breadth and thickness according to the formula:

$$s = \frac{kbt^2}{l},$$

where  $s$  is the strength

$b$  is the breadth in mm

$t$  is the thickness in mm

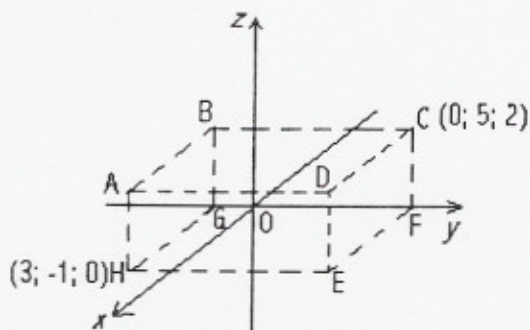
$l$  is the length in mm

$k$  is a constant.

- (i) What kind of proportion is there, (if any), between  $s$  and  $b$ ?
- (ii) What kind of proportion is there, (if any), between  $s$  and  $l$ ?
- (iii) Quickly sketch typical graphs of the kinds of proportion in (i) and (ii).
- (iv) How will the strength change if the thickness is doubled, but the breadth and length stay the same?
- (v) If a plank is required to be 3 times as strong, how can this be done, by changing only the length? (6)  
[9,5]

## Question 5:

a)



Refer to the diagram above.

- (i) What are the coordinates of D?
- (ii) Find the length of HE.
- (iii) Find the length of CH.
- (iv) Give the equation of the plane containing C, D, E and F.
- (v) Give the equation of the plane which is parallel to the plane in (iv), and which passes through the midpoint of DA.

**Question 5 continued:**

- a) (vi) Consider all points  $(x; y; z)$ , such that  $x = 3$  and  $y = 5$ .
- (I) Which part of the diagram contains some of these points?
- (II) Describe where **all** such points are.

(10,5)

- b) Plot the following points given in polar coordinates on separate diagrams:

- (i)  $(3; 90^\circ)$  (ii)  $\left(2\frac{1}{2}; \frac{5\pi}{4}\right)$  (3)

[13,5]

**Question 6:**

- a) The final stages of two Gauss reduction calculations are as shown below in A and B.

A

$x$	$y$	$z$	1
1	2	4	1
0	-1	2	3
0	0	0	0

B

$x$	$y$	$z$	1
1	-2	-1	3
0	4	1	5
0	0	0	3

- (i) For each of A and B, say how many solutions there are for  $(x; y; z)$ . (2)
- (ii) Complete the solutions if possible. (4)

- b) Solve the following problems by constructing equations and solving them:

- (i) A rectangle of area  $154 \text{ m}^2$  has one side 3 m longer than the other. What are the lengths of the sides? (6,5)
- (ii) Someone asks you to find two numbers whose sum is 12 and whose product is 40. By obtaining a quadratic equation, prove that no real numbers can fit these conditions. (6,5)
- (iii) Two cyclists, Mdu and Sipho, ride to meet each other from two towns 100 km apart. Mdu rides at 12 km/h and Sipho at 9 km/h. Mdu starts one hour and twenty minutes before Sipho. How far does Mdu ride before meeting Sipho? (6)

[25]



**Question 7:**a) Solve for  $x$  and show your answers as indicated.

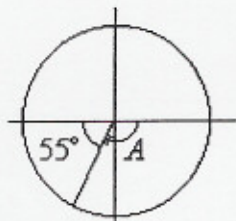
$$(i) \quad -4 \leq 3 - \frac{5x}{2} < 7 \quad \text{Answer in interval notation.} \quad (3)$$

$$(ii) \quad 2x < 5x - 3 \leq 7 \quad \text{Answer in set notation.} \quad (5,5)$$

b) Use a table to solve the following inequality for  $x$ , and give your answer in interval notation.

$$\frac{3}{x-2} < \frac{1}{2x+3} \quad (9,5)$$

[18]

**Question 8:**a) (i) In which quadrant is the angle,  $A$ , shown in the diagram below, and what is the size of angle  $A$ ?

(ii) An arc,  $s$ , is subtended by an angle,  $\theta$ , at the circumference of a circle of radius 3,6 cm. If  $\theta = \frac{5\pi}{8}$ , find  $s$  correct to 3 significant figures. (5)

b) (i) The point,  $Q(3; -2)$  is on the terminal arm of angle  $A$ . Draw angle  $A$  in standard position, and calculate  $\tan A$  and  $\csc A$ .(ii)  $B$  is an angle which is coterminal with angle  $A$  in (i). Find  $\sin B$ .(iii) Using the definitions of trigonometric functions in terms of  $x$ ,  $y$  and  $r$ ,

show that: 
$$\cot \theta = \frac{1}{\tan \theta}$$

(iv) Use the fundamental relationships between trigonometric functions to simplify:

$$\frac{\tan^2 A}{1 + \tan^2 A} \text{ to a single trigonometric function of } A. \quad (11)$$

c) Use a calculator to find correct to 4 decimal places:

$$(i) \quad \sin 76,4^\circ \quad (ii) \quad \tan \frac{2\pi}{7} \quad (iii) \quad \cot \frac{7\pi}{5} \quad (3)$$

d)  $\cos \theta = \frac{5}{13}$ , and  $\theta$  is an acute angle, find  $\theta$  in radian measure to 4 significant figures. (1)

[20]

**Question 9:**

An opinion poll was taken in the United States of America in 1995 for Time magazine.

The question people were asked was:

“What is the main problem facing the country?”

The replies, with the percentage of people giving those replies are in the table below.

<b>Problem</b>	<b>% of people</b>
Budget deficit	7
Crime	20
Drugs	6
Economy	6
Homelessness	3
Lack of Morals	14
Politicians	13
Unemployment	6

- a) Draw a bar chart representing the data in the table.  
b) What other form of graph would have been suitable for this data?  
c) Why do you think the percentages do not add up to 100?

(6)

(1)

(1)

{8