UNIVERSITY OF KWAZULU-NATAL
JUNE 2006 TEST
COURSE AND CODE: FOUNDATION MATHEMATICS (MATH 001)

DURATION: 3 HOURS **MAXIMUM MARKS: 150**

INTERNAL EXAMINER: Mr M. F. Mahlaba

EXTERNAL EXAMINER: Ms H. Tarr

PLEASE NOTE:

1. This paper consists of 14 pages. Check that you have them all.
2. Show all working and attempt all questions.
3. Where appropriate, leave your answers in terms of π.
4. Write your answers in the space provided. If the provided space is not enough, you can use the reverse side of the previous page, i.e. opposite where you are working.
5. Write your student number in the space provided below.

STUDENT NUMBER .....

Question Number	Marks	
	Internal	External
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Total		

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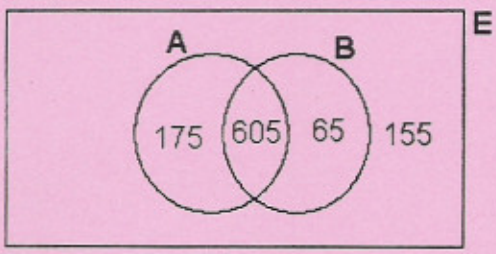
Question 1

(a) If $E = \{2, 3, 4, 5, 6\}$, $A = \{2, 3, 4\}$, $B = \{4, 5, 6\}$, $D = \{6\}$,
show that $(A \cup B \cup D)' = A' \cap B' \cap D'$ (5)

(b) In the Venn diagram,
E is the set of Learners at UShaka High School,
A is the set of Learners who have a brother, and
B is the set of Learners who have a sister



Write down the number who:

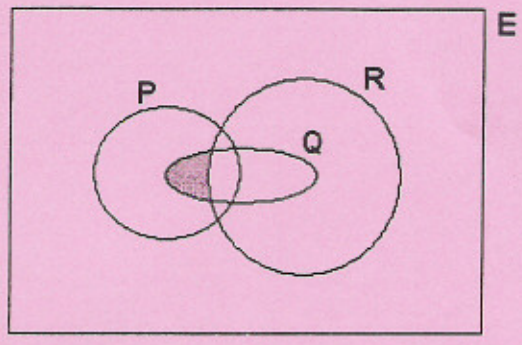
(i) have a brother, ...

(ii) have a sister, ...

(iii) have neither brother nor sister, ...

(iv) are in school altogether. ..... (4)

(c) Use the given Venn diagram to describe the shaded area in set notation.



(4)
[13]

Question 2

(a) If $y = \sqrt{20-4x}$, give any two values of x for which y is a natural number. (2)

(b) State if the following are true or false. If false, give an example to show why the statement is false.

(i) For any integer n, $3n+1$ is an odd integer.

(ii) $(-1)^k = -1$ for all prime numbers k.

(iii) The sum of any two irrational numbers is always irrational

(5)

(c) Show that $0.\dot{8}\dot{4}$ is a rational number. (4)

[11]

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Question 3

(a) The total surface area of a cube is $96\ \text{cm}^2$. Find the volume of a cube. (3½)

(b) A circle of radius r and a square of side x have equal perimeters. What is the ratio of the area of the circle to the area of the square? (6)

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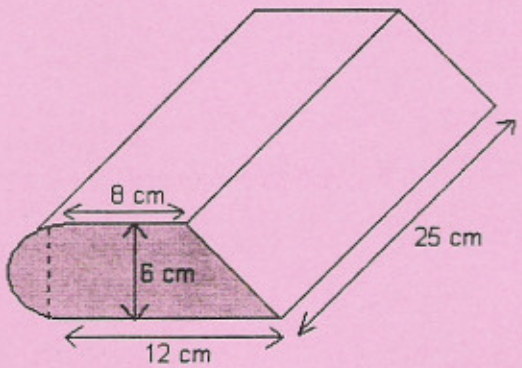
(c) A solid shape has a cross-section which is a trapezium with a semi-circle as in the diagram. The dimensions of the shape are as shown in the diagram.
(Leave your answers in (i), (ii) and (iii) in terms of π and in surd form)

(i) Show that the area of the cross-section is $\left(\frac{9\pi}{2}+60\right)\text{cm}^2$. (3)



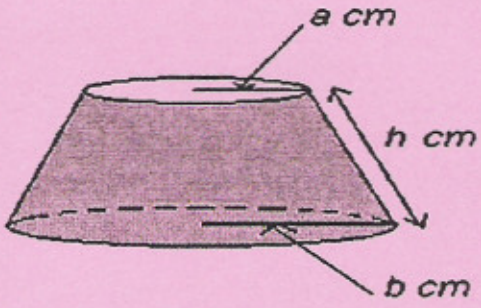
(ii) Calculate the volume of the shape. (2½)

(iii) Calculate the total surface area of the shape (7)

(iv) If all the surfaces are to be painted, how many 1 litre tins of paint must be bought if 1 litre of paint covers $50\,\text{cm}^2$? (3)

(d) One of the formulas in the list below can be used to calculate the area of the material needed to make the curved surface of the lampshade in the diagram.

- $\pi h(a+b)^2$
- $\pi h^2(a+b)$
- $\pi h(a+b)$
- $\pi h^2(a+b)^2$.



Which formula is correct? Give a reason for your answer. (2)

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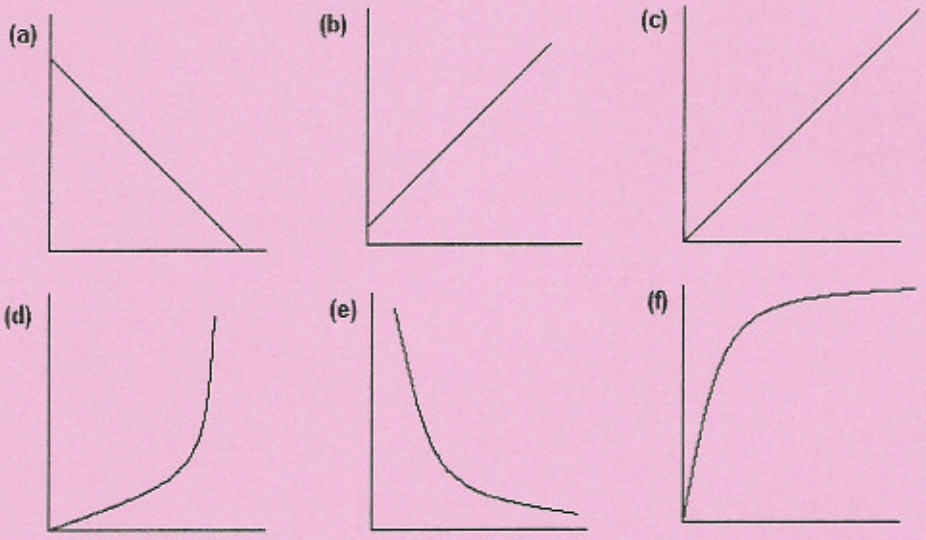
Question 4

(a) Which of the following graphs show a type of proportion, and which type of proportion is it?



(4)

(b) Themba travels at an average speed of 75 km/h and completes a journey in 2 hours. The next day he does the same journey, and this time takes 2.5 hours.

(i) What kind of a proportion is this? Give a reason for your answer.

(ii) What was his average speed on the second day?

(iii) What is the meaning of the constant of proportionality in this example? (7)

[11]

Question 5

(a) Use the Gauss reduction method to solve the following system of equations:

$x + 2y + z = 3$

$2x + y + z = 16$

$x + y + 2z = 9$ (7)

(b) The final stage of Gauss reduction is shown. Complete the solution.

u	v	w	1
1	-1	1	1
0	2	1	3
0	0	0	0

(4)

[11]

Question 6

(a) Three consecutive integers are such that $\frac{5}{6}$ of the largest minus $\frac{3}{4}$ of the smallest is equal to $\frac{2}{5}$ of the middle number. Determine the three integers. (5)

(b) Tickets at Ster Kinekor cinema are sold at R7 for children and at R22 for adults. 145 tickets are sold and the total income is R2 290. How many tickets for children and how many tickets for adults were sold? (6)

[11]

Question 7

(a) For which value(s) of x will $\dfrac{(x+3)(x-2)}{x+5}$ be zero? (2)

(b) Solve for x and illustrate your solution graphically: $-\dfrac{3}{5} < \dfrac{2-x}{2} \leq 0.5$ (6)

(c) Use the table method to solve for x and write your solution in interval notation:

$$\frac{1}{x-1}+1 > \frac{1}{x+1}$$ (8)

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Question 8

(a) Find the domain (in interval notation) of each of the following functions:

(i) $f(x) = \sqrt{5-3x}$ (3)

(ii) $g(x) = \dfrac{1}{x^2+x-6}$ (4)

(b) Find a value t such that the slope of the line passing through $(-4, 3)$ and $(t, 13)$ is 2. (3)

(c) Let $f(x) = 3-2x$.

(i) Find $f^{-1}(x)$ (2)

(ii) Show that $(f \circ f^{-1})(x) = (f^{-1} \circ f)(x) = x$ (5)

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Question 9

Given the following:

$g(x) = \{(1, 2), (2, 4), (3, 5), (3, 3)\}$ and $h(x) = -\frac{1}{3}x^2 + 2x - 6$

(a) Is $g(x)$ a function? Give a reason for your answer. (2)

(b) Write down the inverse of $g(x)$ and call it $G(x)$. (2)

(c) Draw the graph of $g(x)$. (2)

(d) Find the range of $h(x)$. Give your answer in set builder notation. (4)

(e) Find the equation of the inverse of $h(x)$. (3)

(f) Give $j(x)$, the greatest restriction of $h(x)$, so that $j^{-1}(x)$ is a function. (1)

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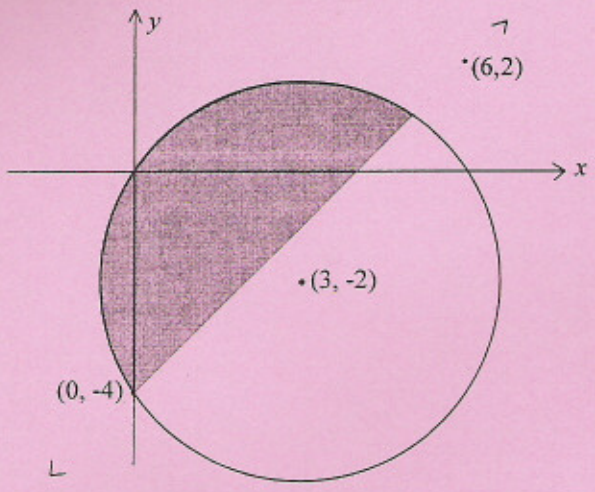
Question 10

(a) Consider the diagram below:



(i) Write the equation of the circle. (3)

(ii) Write the equation of the line. (2)

(iii) Write the definition of the shaded area. (4)

(b) Consider the function $y-2=\frac{1}{x+4}$

(i) Write down the horizontal and the vertical asymptotes of the above function. (2)

(ii) Draw the graph of the above function. Indicate intercepts on your graph. (6)

(iii) Give, in set builder notation, the domain and the range of the above function. (2)

[19]