EXAMINATIONS COUNCIL OF LESOTHO
Lesotho General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	CANDIDATE NUMBER

MATHEMATICS **0178/04**

Paper 4 (Extended) **May/June 2018**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic Calculator
Geometrical Instruments
Tracing Paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π use either your calculator value or 3.142.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

1 (a) Evaluate $\frac{1}{4} + 20\%$.

Give your answer as a fraction.

Answer (a) ..... [1]

(b) In 2014, the number of people affected by an epidemic was 72 350 600, correct to the nearest hundred.

(i) Write this number 72 350 600 in words.

Answer (b)(i) .....

..... [1]

(ii) Find the lower-bound to the number of people affected by the epidemic in 2014.

Answer (b)(ii) ..... [1]

(iii) Write the number 72 350 600 correct to the nearest hundred thousand.

Answer (b)(iii) ..... [1]

(c) Pule and Thabo receive a sum of money from their father and share it in the ratio 3:2.

Thabo receives M1430.40.

(i) Calculate the total amount they received from their father.

Answer (c)(i) M ..... [2]

(ii) Their father invests M6000 in company A and M5000 in company B.
I Company A pays simple interest at the rate of 4% per year.
II Company B pays compound interest at the rate of 5% per year.

From which company will he get more interest after 5 years and by how much?

2 $\mathbf{A} = \begin{pmatrix} -1 & 2 \\ 0 & 1 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 2 & 0 \\ 1 & 4 \end{pmatrix}$ $\mathbf{C} = (2 \quad -3)$.

Find the following matrices.

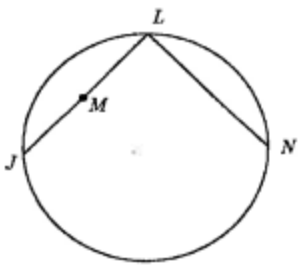
(a) **CA**

Answer (a) $\begin{pmatrix} \quad \end{pmatrix}$ [2]

(b) $\mathbf{B}^{-1}$

Answer (b) $\begin{pmatrix} \quad \end{pmatrix}$ [2]

3 **(a)** In the diagram, JL and LN are chords of a circle equidistant from the centre.
M is the mid-point of JL.



(i) Use accurate construction to find the centre of a circle and label it C. [2]

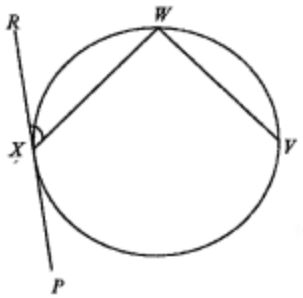
(ii) State the relationship between JM and LN.

Give a reason.

Answer (a)(ii) Relationship: ..... [1]

Reason ..... [1]

(b) The diagram shows a circle with two equal chords VW and WX.
PR is a tangent to the circle at a point X.



NOT TO SCALE

Reflex angle VWX is 270°.

Calculate the size of the marked angle WXR.

Answer (b) $\widehat{WXR}$ = ... [3]

4 (a) Simplify

$$\frac{x^2-1}{2x^2+5x+3}.$$

Answer (a) ..... [4]

(b) y varies inversely as the square root of x.

When $x = 16$, $y = 9$.

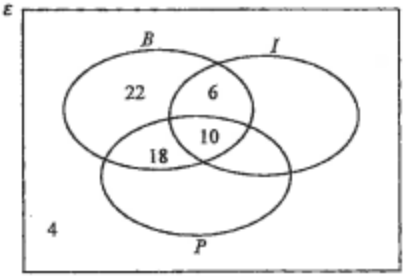
(i) Find the formula for y in terms of x.

Answer (b)(i) ..... [2]

(ii) Find the value of x when $y = 18$.

Answer (b)(ii) ..... [3]

5 In a survey, 60 students are asked whether they have Birth Certificates (B), Identity Documents (I) or Passports (P).
The results are represented in the Venn diagram.



(a) Find the number of students who have

(i) all the three documents,

Answer (a)(i)..... [1]

(ii) Birth Certificates and Identity Documents only.

Answer (a)(ii)..... [1]

(b) Find $n(B \cap P \cap I')$

Answer (b)..... [1]

(c) Use set notation to represent the number of students who have Birth Certificates only.

Answer (c) ..... [1]

6 It is given that f and g are functions of x.

$f(x) = \frac{1}{x+2} + 3$ and $g(x) = 3 - 2x$

(a) Evaluate.

(i) $g(-7)$

Answer (a)(i) ..... [2]

(ii) $fg(3)$

Answer (a)(ii) ..... [3]

(b) Find the value of x for which

$f(x) = 0$.

Answer (b) ..... [2]

(c) Express in terms of x

(i) $g^{-1}(x)$,

Answer (c)(i) ..... [2]

(ii) $g(x)g(x)$.

Answer (c)(ii) ..... [2]

(d) Given that p is another function of x such that $p(x) = x^n$.

Find n if $p(x) = p^{-1}(x)$.

7 Anna types x words in one minute.

(a) Show that Anna takes $\frac{12000}{x}$ seconds to type 200 words.

Answer (a) ..... [1]

(b) Puleng types 10 fewer words than Anna in one minute.

Write an expression, in terms of x for

(i) the number of words Puleng types in one minute,

Answer (b)(i) ..... [1]

(ii) the number of seconds Puleng takes to type 200 words.

Answer (b)(ii) ..... [1]

(c) It takes Puleng 100 seconds longer to type 200 words than it takes Anna.

(i) Write an equation in x to represent this information and show that it simplifies to $x^2 - 10x - 1200 = 0$.

Answer (c)(i) ..... [3]

(ii) Solve the equation $x^2 - 10x - 1200 = 0$.

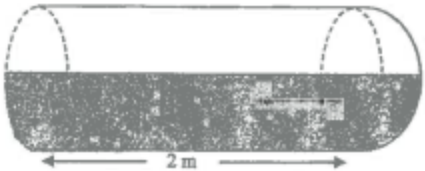
Answer (c)(ii) $x =$ ..... or $x =$ ..... [3]

(iii) Find the time taken, in minutes, for Puleng to type 3510 words.

Answer (c)(iii) ..... min [2]

8 The diagram shows a container made by joining a cylinder of radius 0.3 m and a hemisphere of the same radius.
The length of the cylinder is 2 m.

The container rests on a horizontal surface and it is exactly half filled with water.



NOT TO SCALE

[The volume of a sphere is $\frac{4}{3}\pi r^3$]

[The surface area of a sphere is $4\pi r^2$]

(a) Calculate the surface area of the container that is in contact with the water.

Answer (a) ..... m^2 [4]

(b) The container is now completely filled with water.

Calculate the total volume, in litres, of water in the container.
Note ($1000\ cm^3 = 1$ litre)

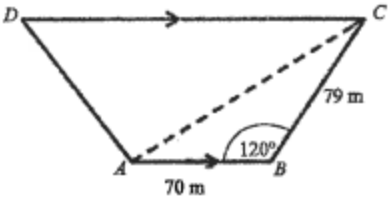
Answer (b) ..... *l* [4]

(c) Water is taken from the container at the constant rate of 10 litres per minute.

Find the length of time needed to draw 300 litres of water from the container.

Answer (c) ..... min [2]

9 The diagram represents a field, $ABCD$ in the shape of a quadrilateral.
AC is a straight footpath across the field and DC is parallel to AB.



NOT TO SCALE

$AB = 70$ m, $BC = 79$ m and $A\hat{B}C = 120°$.

(a) Calculate the distance AC.

Answer (a) ..... m [4]

(b) Calculate the area of triangle ABC.

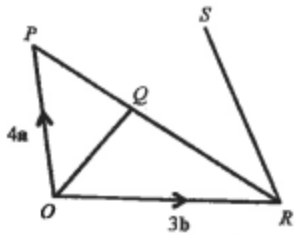
Answer (b) ..... m^2 [2]

(c) A farmer walks the shortest distance from point B to line DC.

Calculate this distance.

Answer (c) ..... m [2]

10 In the diagram $\overrightarrow{OR} = 3\mathbf{b}$, $\overrightarrow{OP} = 4\mathbf{a}$ and $\overrightarrow{RS} = 6\mathbf{a}$.
Q lies on PR such that PQ : QR = 2:3.



NOT TO SCALE

(a) Find the following in terms of **a** and **b**, giving each answer in its simplest form.

(i) $\overrightarrow{PR}$

Answer (a)(i) $\overrightarrow{PR}$ = ... [1]

(ii) $\overrightarrow{OQ}$

Answer (a)(ii) $\overrightarrow{OQ}$ = ... [2]

(b) Find $\overrightarrow{OS}$, in terms of **a** and **b** and hence show that $\overrightarrow{OQ} = \frac{2}{5}\overrightarrow{OS}$.

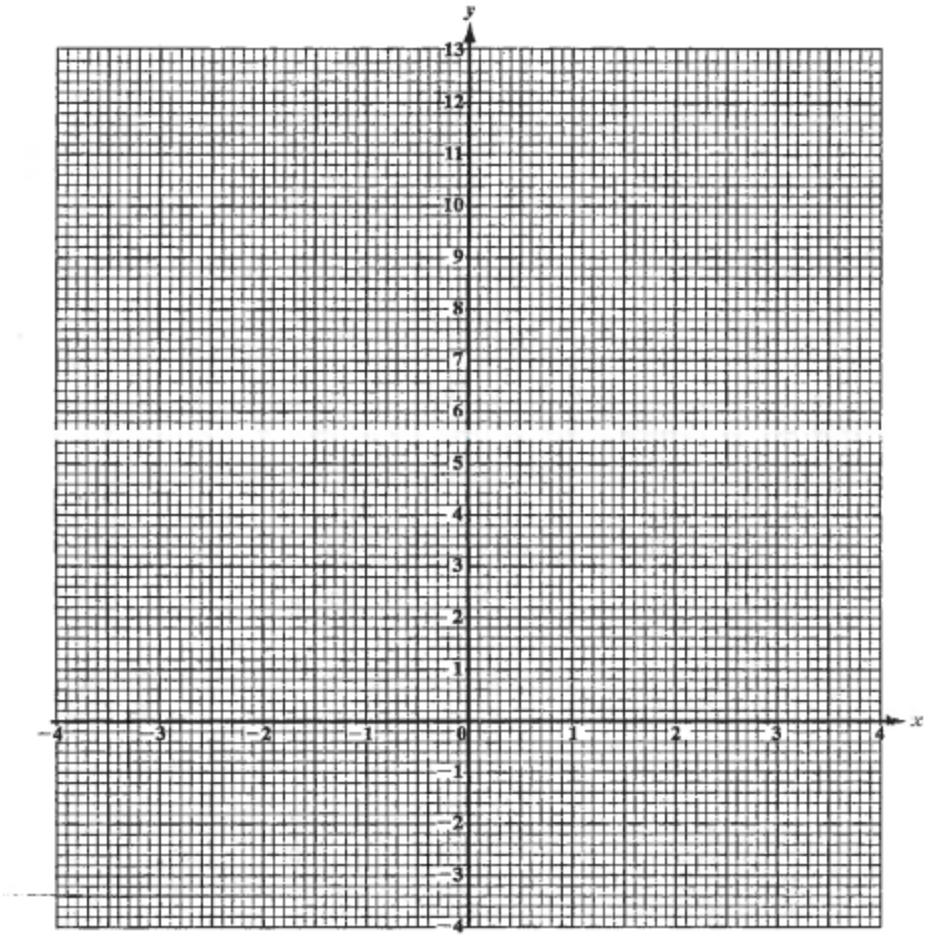
Answer (b) ..... [3]

11 (a) Complete the table of values for $y=\frac{1}{3}x^3+x^2-2x$.

x	−4	−3	−2	−1	0	1	2	3
y	2.7		5.3	2.7	0	−0.7		12

[2]

(b) On the grid, draw the graph of $y=\frac{1}{3}x^3+x^2-2x$ for $-4 \leq x \leq 3$.



[4]

(c) Use the graph to solve the equation $\frac{1}{3}x^3+x^2-2x=4$.

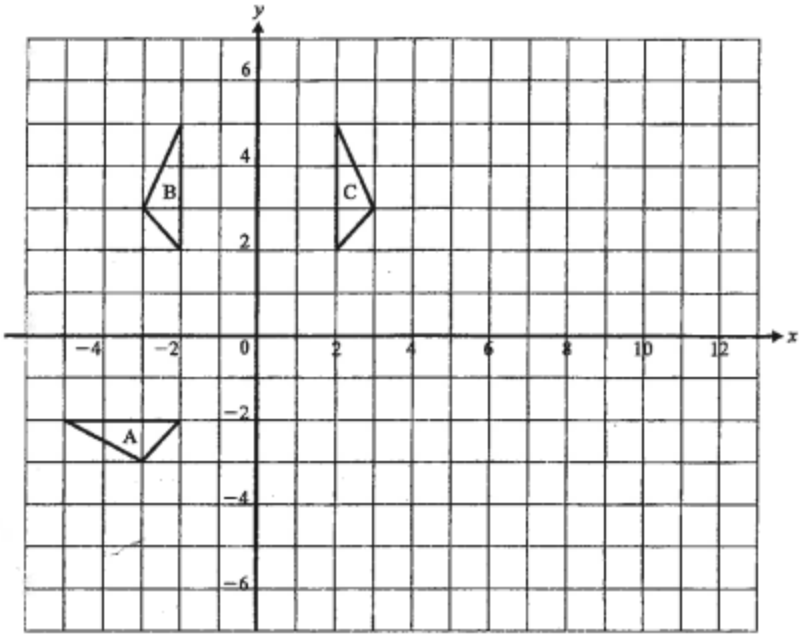
Answer (c) $x =$ ..... or $x =$ ..... or $x =$ ..... [3]

(d) The equation $\frac{1}{3}x^3+x^2-7=5x$ can be solved by drawing a straight line on the grid.

Find the equation of this straight line in the form of $y = mx + c$.

Answer (d) $y =$ ..... [2]

12 The diagram shows triangles A, B and C.



(a) Describe **fully** the single transformation that maps triangle

(i) A onto C,

Answer (a)(i) .....

..... [2]

(ii) A onto B.

Answer (a)(ii) .....

..... [3]

(b) On the same grid, draw the image of triangle C after a shear, with invariant line $y = 0$ and shear factor 2. [2]

13 (a) There are 25 red marbles and x blue marbles in a box.
One marble is selected at random.

(i) Given that the probability that it is blue is $\frac{1}{6}$, calculate the value of x.

Answer (a)(i) $x =$ ..... [3]

(ii) Find the number of marbles that are in the box.

Answer (a)(ii)..... [1]

(b) In another box there are 27 green marbles and 13 yellow marbles.
Two marbles are selected at random without replacement.

Calculate the probability that

(i) both marbles are green,

Answer (b)(i) ..... [2]

(ii) there is at least one yellow marble.

Answer (b)(ii) ..... [2]

14 The table shows the masses, m grams, of 44 plant seeds.

Mass (g)	$10 \leq m < 20$	$20 \leq m < 25$	$25 \leq m < 35$	$35 \leq m < 50$	$50 \leq m < 55$
Frequency	8	5	11	18	2

(a) (i) Find the modal class.

Answer (a)(i) ..... [1]

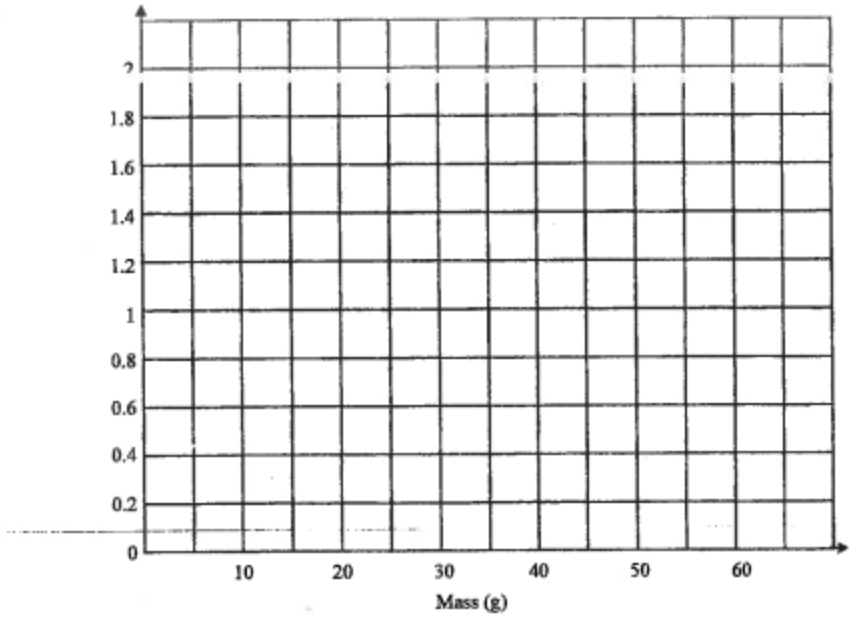
(ii) Find the class that contains the median.

Answer (a)(ii) ..... [1]

(iii) Calculate an estimate of the mean.

Answer (a)(iii) ..... g [4]

(b) Draw a histogram to represent the information in the table.



[4]

15 A school transports learners to a stadium using two types of vehicles (mini-buses and taxis). Each trip should have at least one mini-bus and one taxi but not more than six vehicles altogether.
A mini-bus can carry up to 60 learners while a taxi can carry up to 15 learners.

(a) (i) Given that every vehicle must carry the maximum number of learners, find the minimum number of learners that can be transported in one trip.

Answer (a)(i) ..... [1]

(ii) Taking b for the number of mini-buses used and t for the number of taxis used, write an expression for the number of learners that can be transported.

Answer (a)(ii) ..... [2]

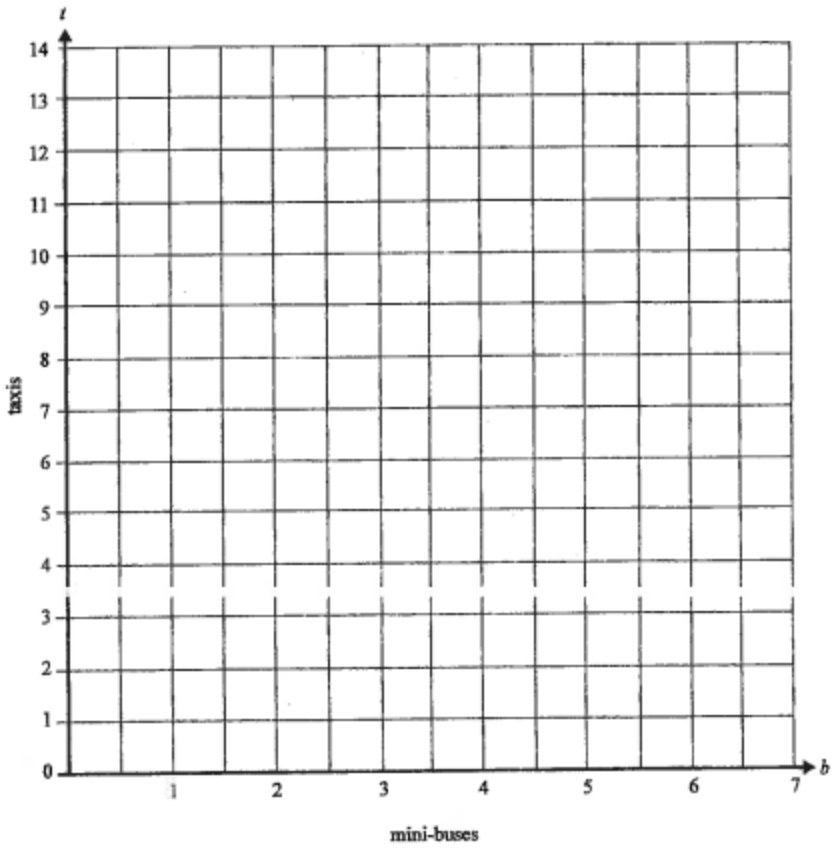
(b) The school has at most 180 learners to transport.

(i) Use this information to form an inequality in b and t

Answer (b)(i) ..... [1]

(ii) Two other inequalities defining region R, of the possible values of b and t are $t \geq 1$, $b \geq 1$ and $b + t \leq 6$.

Use the inequalities to represent the region R on the grid provided.



[4]

(c) Transport costs are M800 per mini-bus and M400 per taxi.

Find the least possible cost, to the school, of transporting the learners.