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Geylang Methodist School (Secondary) Mid-Year Examination 2014

Candidate
Name

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Class

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Index Number

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MATHEMATICS

4016/01

Paper 1

Sec 3 Express
Sec Hope 3-1

Candidates answer on the Question Paper.

1 hour 30 minutes

Setter : Mr Wong Han Ming / Ms Ng Siew Lee

12May 2014

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagram or graph.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in the loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to 3 significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 60.

For Examiner's Use

60

This document consists of 12 printed pages.

[Turn over

Mathematical Formulae

Compound interest

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved Surface Area of a cone} = \pi r l$$

$$\text{Surface Area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

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$$\text{Area of triangle } ABC = \frac{1}{2} ab \sin C$$

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Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

For
Examiner's
UseAnswer **all** the questions.For
Examiner's
Use

- 1 Solve the simultaneous equations

$$\begin{aligned} 2x + 5y &= -12, \\ 4x + y &= 3. \end{aligned}$$

Answer $x =$ _____
 $y =$ _____ [3]

- 2 (a) Solve
- $(2x - 1)(x + 1) = 5$
- .

Answer $x =$ _____ or _____ [1]

- (b) Simplify
- $2y - 4(y + 1)$
- .

Answer _____ [1]

- 3 An airline allows every passenger to carry up to 10 kg of luggage onto their airplane. Any passenger who wishes to carry luggage in excess of 10 kg will need to pay a fee of \$15 per kg.

- (a) Mr Lim has 3 bags weighing 4 kg, 7 kg, and 2 kg respectively. How much does he have to pay?

Answer (a) \$ _____ [1]

- (b) Mrs Tan has 2 suitcases, each weighing 6 kg. At the airport, she buys some souvenirs that weigh a total of 3 kg. How much does she have to pay?

Answer (b) \$ _____ [1]

For
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For
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- 4 (a) Express 5292 as a product of its prime factors.

Answer (a) $5292 =$ _____ [1]

- (b) Find the smallest integer value of k for which $5292k$ is a cubic number.

Answer (b) $k =$ _____ [1]

- 5 (a) Two interior angles of an octagon are 200° and 262° respectively. If the remaining interior angles are the same, and have the value, x° , find the value of x .

Answer (a) $x =$ _____ [2]

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- 6 A cylinder of radius 6 cm is half filled with water. Given that the volume of water in the cylinder is $1800\pi \text{ cm}^3$, find the height of the cylinder.

Answer _____ cm [3]

- 7 (a) Simplify $\frac{2x+3}{7} - \frac{x-1}{3}$, expressing your answer as a single fraction.

Answer (a) _____ [2]

- (b) Solve the equation $\frac{3x-1}{2} - \frac{2x+3}{5} = 0$.

Answer (b) $x =$ _____ [2]

For
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- 8 (a) Factorise completely $12x^2 - 3y^2$.

Answer (a) _____ [2]

- (b) Factorise completely $3x^2 - 10x - 8$.

Answer (b) _____ [2]

- 9 (a) A map has a scale of 1 cm : 5 km. If distance from Town A to Town B is 36 km, find the distance between the two towns on the map in cm.

Answer (a) _____ cm [2]

- (b) Town A has an area of 5 cm² on the map. Find the actual area of Town A in square kilometers.

Answer (b) _____ km² [2]

For
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- 10 A sum of money is divided among Angie, Beth and Candy in the ratio 3 : 5 : 9. If Beth received \$60 more than Angie, find the amount of money Candy received.

Answer \$ _____ [2]

- 11 (a) The coordinates of point P is (6, -3) and the coordinates of point Q is (-2, -9). Find the length of PQ .

Answer (a) _____ units [2]

- (b) Find the gradient of PQ .

Answer (b) _____ [2]

- 12 Darren bought a HDB apartment for \$400 000. He sells it 3 years later, making a profit of 30% of the original price. Calculate the price at which he sold the apartment for.

Answer \$ _____ [2]

For
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- 13 A triangular field, ABC has $AB = 50$ m, $BC = 60$ m and $AC = 90$ m.

For
Examiner's
Use

- (a) Using a scale of 1 cm to 10 m, draw the triangle ABC in the space below. The line AB is provided for you. [3]
- (b) Construct the perpendicular bisector of AC . [1]
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- (d) A scarecrow was placed in the field at a position where it is closer to point A than point C . It is also closer to the line AC than AB . Shade the part of the field where the scarecrow may be placed. [1]

A  B

For
Examiner's
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- 14 An atom of helium has a mass of 0.68×10^{-11} picograms.

(a) Express the mass in grams, giving your answer in standard form.

Answer (a) _____ g [1]

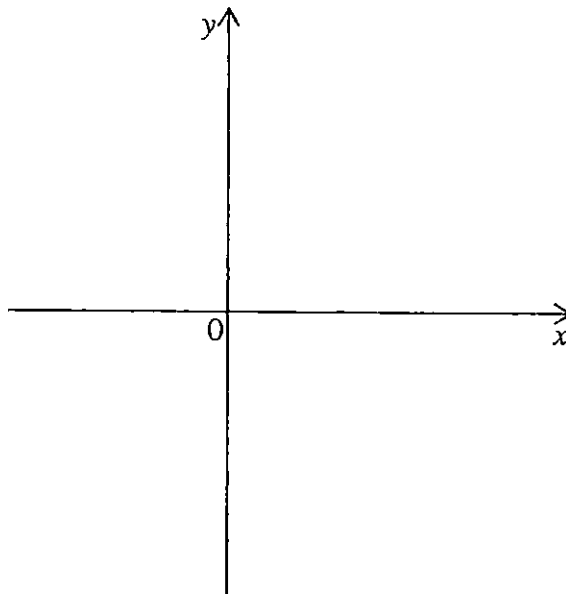
- (b) A room contains 9×10^{22} atoms of helium.
Find the mass of helium in the room, giving your answer in grams as a decimal.

Answer (b) _____ g [2]

- 15 (a) (i) Express $x^2 - 6x + 5$ in the form $(x-a)^2 + b$.

Answer (a)(i) _____ [1]

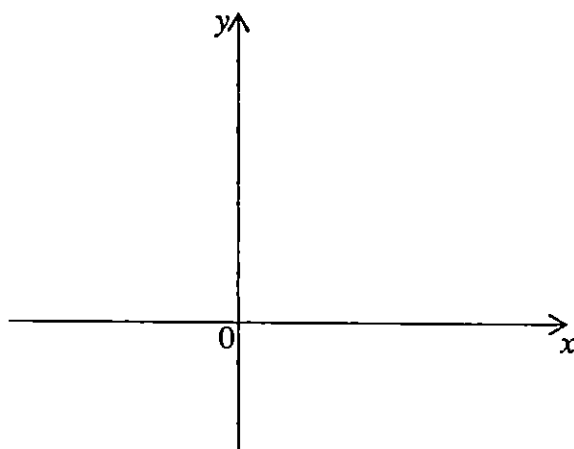
- (ii) Hence, sketch the graph of $y = x^2 - 6x + 5$ on the given axes.



[2]

For
Examiner's
Use

- (b) (i) Sketch the graph of $y = x(4 - x)$ on the given axes.



[2]

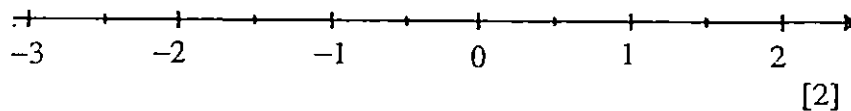
- (ii) Write the equation of the line of symmetry of $y = x(4 - x)$.

Answer (b)(ii) _____ [1]

- 16 Given that $\frac{1}{3}(x + 1) \leq x + 2 < 3$

- (a) Solve the inequality.
Show your solution on the number line below.

Answer



[2]

- (b) Hence, state the smallest rational value of x .

Answer (b) _____ [1]

For
Examiner's
UseFor
Examiner's
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17 (a) Calculate $\frac{2\frac{3}{4} + 1\frac{5}{16} \times \frac{4}{9}}{\left(2\frac{1}{7}\right)^2 - 1\frac{1}{2}}$.

Write down the first five digits on your calculator display.

Answer (a) _____ [1]

(b) Write your answer to part (a) correct to 3 significant figures.

Answer (b) _____ [1]

- 18 Ten grams of protein is found in x grams of beans.
Find an expression, in terms of x and y , the mass of protein in y kilograms of beans. Give your answer in kilograms.

Answer _____ kg [2]

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- 19 (a) (i) Simplify $\frac{a}{\sqrt[5]{a}}$ and give your answer in the form a^n .

For
Examiner's
Use

Answer (a)(i) _____ [1]

- (ii) Simplify $\left(\frac{8}{x^3}\right)^{\frac{1}{3}}$.

Answer (a)(ii) _____ [1]

- (b) Given that $\frac{1}{8} \times 16^{\frac{1}{4}} = 2^k$, find k .

Answer (b) _____ [1]

- END OF PAPER 1-



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Candidate
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- 1 Solve the simultaneous equations

$$\begin{aligned} 2x + 5y &= -12, \\ 4x + y &= 3. \end{aligned}$$

$$\begin{aligned} \text{Answer } x &= \underline{1.5} \\ y &= \underline{-3} \quad [3] \end{aligned}$$

- 2 (a) Solve
- $(2x - 1)(x + 1) = 5$
- .

$$\text{Answer } x = \underline{1.5 \text{ or } -2} \quad [1]$$

- (b) Simplify
- $2y - 4(y + 1)$
- .

$$\text{Answer } \underline{-2y - 4} \quad [1]$$

- 3 An airline allows every passenger to carry up to 10 kg of luggage onto their airplane. Any passenger who wishes to carry luggage in excess of 10 kg will need to pay a fee of \$15 per kg.

- (a) Mr Lim has 3 bags weighing 4 kg, 7 kg, and 2 kg respectively. How much does he have to pay?

$$\text{Answer (a) } \underline{\$ 45} \quad [1]$$

- (b) Mrs Tan has 2 suitcases, each weighing 6 kg. At the airport, she buys some souvenirs that weigh a total of 3 kg. How much does she have to pay?

$$\text{Answer (b) } \underline{\$ 75} \quad [1]$$

[Turn over3

For
Examiner's
Use

For
Examiner's
Use

- 4 (a) Express 5292 as a product of its prime factors.

Answer (a) $5292 = 2^2 \times 3^3 \times 7^2$ [1]

- (b) Find the smallest integer value of k for which $5292k$ is a cubic number.

Answer (b) $k = 14$ [1]

- 5 (a) Two interior angles of an octagon are 200° and 262° respectively. If the remaining interior angles are the same, and have the value, x° , find the value of x .

Answer (a) $x = 103$ [2]

- (b) Find the value of each exterior angle of a regular hexagon.

Answer (b) 60° [1]

For
Examiner's
Use

For
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Use

- 6 A cylinder of radius 6 cm is half filled with water. Given that the volume of water in the cylinder is $1800\pi \text{ cm}^3$, find the height of the cylinder.

Answer _____ 100 cm [3]

- 7 (a) Simplify $\frac{2x+3}{7} - \frac{x-1}{3}$, expressing your answer as a single fraction.

Answer (a) $\frac{-x+16}{21}$ [2]

- (b) Solve the equation $\frac{3x-1}{2} - \frac{2x+3}{5} = 0$.

Answer (b) $x = 1$ [2]

For
Examiner's
Use

For
Examiner's
Use

- 8 (a) Factorise completely $12x^2 - 3y^2$.

Answer (a) $3(2x + y)(2x - y)$ [2]

- (b) Factorise completely $3x^2 - 10x - 8$.

Answer (b) $(3x + 2)(x - 4)$ [2]

- 9 (a) A map has a scale of 1 cm : 5 km. If distance from Town A to Town B is 36 km, find the distance between the two towns on the map in cm.

Answer (a) 7.2 cm [2]

- (b) Town A has an area of 5 cm² on the map. Find the actual area of Town A in square kilometers.

Answer (b) 125 km² [2]

For
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Use

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- 10 A sum of money is divided among Angie, Beth and Candy in the ratio 3 : 5 : 9. If Beth received \$60 more than Angie, find the amount of money Candy received.

Answer \$ 270 [2]

- 11 (a) The coordinates of point P is (6, -3) and the coordinates of point Q is (-2, -9). Find the length of PQ .

Answer (a) 10 units [2]

- (b) Find the gradient of PQ .

Answer (b) 0.75 [2]

- 12 Darren bought a HDB apartment for \$400 000. He sells it 3 years later, making a profit of 30% of the original price. Calculate the price at which he sold the apartment for.

Answer \$ 520 000 [2]

For
Examiner's
Use

13

A triangular field, ABC has $AB = 50$ m, $BC = 60$ m and $AC = 90$ m.

- (a) Using a scale of 1 cm to 10 m, draw the triangle ABC in the space below. The line AB is provided for you. [3]
- (b) Construct the perpendicular bisector of AC . [1]
- (c) Construct a line that is equidistant from AB and AC . [1]
- (d) A scarecrow was placed in the field at a position where it is closer to point A than point C . It is also closer to the line AC than AB . Shade the part of the field where the scarecrow may be placed. [1]

For
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Use

A  B

For
Examiner's
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- 14 An atom of helium has a mass of 0.68×10^{-11} picograms.

- (a) Express the mass in grams, giving your answer in standard form.

$$\begin{aligned} 0.68 \times 10^{-11} \text{ picograms} &= 0.68 \times 10^{-11} \times 10^{-12} \\ &= 6.8 \times 10^{-24} \text{ grams} \end{aligned}$$

Answer (a) 6.8×10^{-24} g [1]

- (b) A room contains 9×10^{22} atoms of helium.
Find the mass of helium in the room, giving your answer in grams as a decimal.

$$\begin{aligned} \text{Mass} &= 9 \times 10^{22} \times 6.8 \times 10^{-24} \text{ grams} \\ &= 0.612 \end{aligned}$$

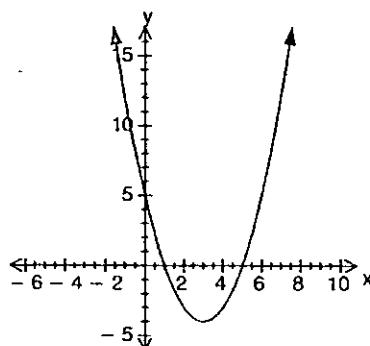
Answer (b) 0.612 g [2]

- 15 (a) (i) Express $x^2 - 6x + 5$ in the form $(x-a)^2 + b$.

$$\begin{aligned} x^2 - 6x + 5 &= (x-3)^2 - 3^2 + 5 \\ &= (x-3)^2 - 4 \end{aligned}$$

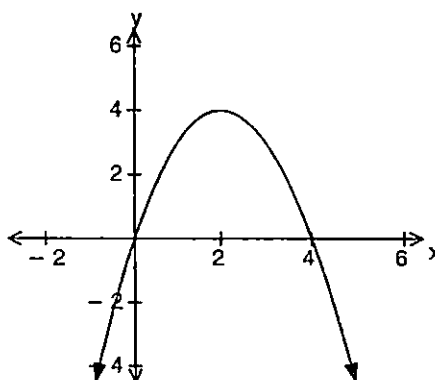
Answer (a)(i) $(x-3)^2 - 4$ [1]

- (ii) Hence, sketch the graph of $y = x^2 - 6x + 5$ on the given axes.



[2]

- (b) (i) Sketch the graph of $y = x(4 - x)$ on the given axes.



[2]

- (ii) Write the equation of the line of symmetry of $y = x(4 - x)$.

Answer (b)(ii) $x = 2$ [1]

- 16 Given that $\frac{1}{3}(x + 1) \leq x + 2 < 3$

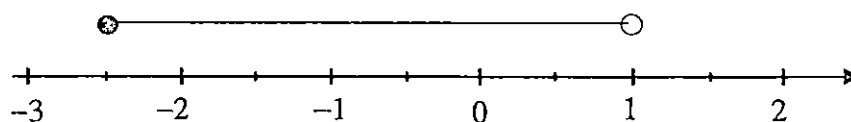
- (a) Solve the inequality.
Show your solution on the number line below.

$$\frac{1}{3}(x + 1) \leq x + 2 \text{ and } x + 2 < 3$$

$$x + 1 \leq 3x + 6 \text{ and } x < 1$$

$$x \geq -2.5 \text{ and } x < 1$$

Answer



[2]

- (b) Hence, state the smallest rational value of x .

Answer (b) $-2\frac{1}{2}$ [1]

For
Examiner's
UseFor
Examiner's
Use

17 (a) Calculate $\frac{2\frac{3}{4} + 1\frac{5}{16} \times \frac{4}{9}}{\left(2\frac{1}{7}\right)^2 - 1\frac{1}{2}}$.

Write down the first five digits on your calculator display.

Answer (a) 1.0781 [1]

(b) Write your answer to part (a) correct to 3 significant figures.

Answer (b) 1.08 [1]

- 18 Ten grams of protein is found in x grams of beans.
Find an expression, in terms of x and y , the mass of protein in y kilograms of beans. Give your answer in kilograms.

$$x \text{ g} \rightarrow 10 \text{ g}$$

$$1000y \text{ g} \rightarrow \frac{10}{x} \times 1000y = \frac{10000y}{x}$$

Answer $\frac{10000y}{x} \text{ kg}$ [2]

For
Examiner's
UseFor
Examiner's
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- 19 (a) (i) Simplify $\frac{a}{\sqrt[5]{a}}$ and give your answer in the form a^n .

$$\frac{a}{\sqrt[5]{a}} = a^{1-\frac{1}{5}} = a^{\frac{4}{5}}$$

Answer (a)(i) $\frac{a^{\frac{4}{5}}}{\phantom{a^{\frac{4}{5}}}}$ [1]

- (ii) Simplify $\left(\frac{8}{x^3}\right)^{-\frac{1}{3}}$.

$$\begin{aligned}\left(\frac{8}{x^3}\right)^{-\frac{1}{3}} &= \left(\frac{x^3}{8}\right)^{\frac{1}{3}} \\ &= \frac{x}{2}\end{aligned}$$

Answer (a)(ii) $\frac{x}{2}$ [1]

- (b) Given that $\frac{1}{8} \times 16^{\frac{1}{4}} = 2^k$, find k .

$$\begin{aligned}\frac{1}{8} \times 16^{\frac{1}{4}} &= 2^k \\ 2^{-3} \times 2 &= 2^k \\ 2^{-2} &= 2^k \\ k &= -2\end{aligned}$$

Answer (b) $k = -2$ [1]

- END OF PAPER 1 -

Answers for MYE 2014 E Maths Paper 1

1	$x = 1.5 ; y = -3$		



Geylang Methodist School (Secondary) Mid-Year Examination 2014

ELEMENTARY MATHEMATICS

4016/02

Paper 2

3 Express

Hope 3 – 1

Additional materials : Writing Paper

1 hours 30 minutes

Setter : Mr Joseph Lim

8 May 2014

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in

Write in dark blue or black pen on both sides of the paper.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions

Write your answers on the separate Writing Papers provided.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of a scientific calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

For π , use either the calculator value or 3.142.

At the end of the examination, fasten all your work securely together.

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[Turn over

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Statistics

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$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

1 The number of listeners at a radio station in 2012 was 320 000.

- (a) In 2013, there were 386 000 listeners. Calculate the percentage increase in the number of listeners from 2012 to 2013. [2]

Each year, the radio station invites its listeners to vote for their favorite deejay.

- (b) In 2012, 16% of the listeners voted. Calculate the number of listeners who voted. [1]
- (c) In 2014, the number of listeners was 510 000 and 105 705 of these voted.
- (i) Calculate the percentage of listeners who voted in 2014, giving your answer correct to the nearest whole number. [2]
- (ii) The number who voted in 2014 was 35% more than in 2013. Calculate the number who voted in 2013. [2]

- 2** (a) Simplify $\frac{p^2 + 5p - 6}{p^2 - 36}$. [2]

- (b) Express as a single fraction in its simplest form $\frac{3}{(x-2)^2} - \frac{4}{x-2}$. [2]

- (c) It is given that $w^2 = v^2 - 8cd$.

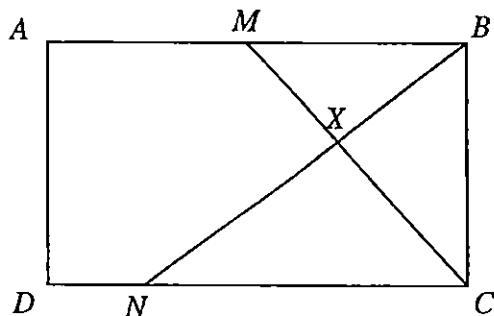
- (i) Find w when $v = 31$, $c = 1.65$ and $d = 19$. [2]

- (ii) Express v in terms of w , c and d . [2]

- (d) Given that $\frac{7a-2b}{4a+3b} = \frac{3}{2}$, find the value of $\frac{a}{b}$. [3]

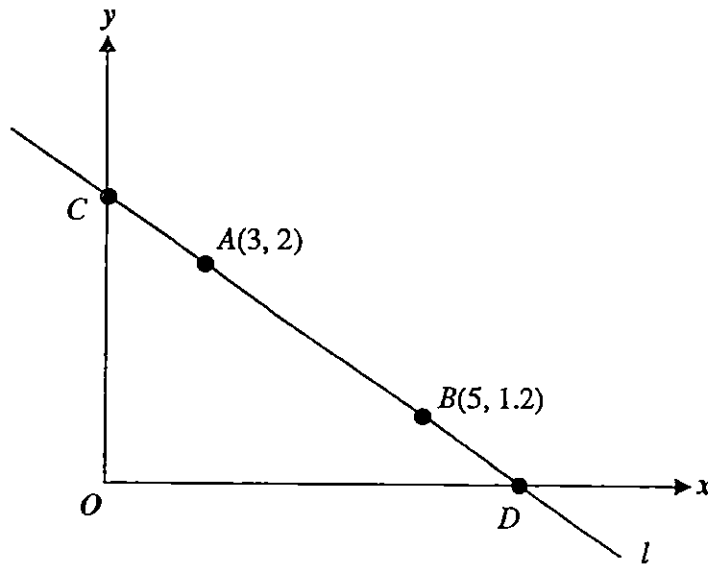
- (e) Find the value of x when $\sqrt[3]{27^x} = \frac{1}{3}$. [2]

- 3 $ABCD$ is a rectangle. M is the mid-point of AB and N is a point on CD .
 MC and BN meet at X .



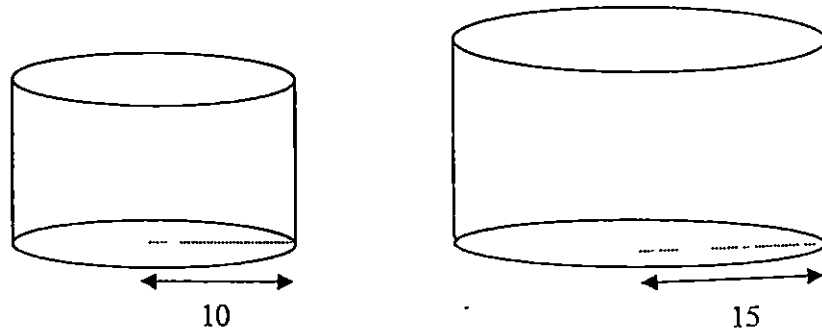
- (a) Prove that $\triangle CXN$ and $\triangle MXB$ are similar. [2]
- (b) Given that $CN = 3ND$, find the ratio
- (i) area of $\triangle CXN$: area of $\triangle MXB$, [1]
- (ii) area of $\triangle BXC$: area of rectangle $ABCD$. [2]
- 4 The speed of a boat in still water is 55 km/h and that of the current is x km/h.
- (a) Find an expression for the speed of the boat
- (i) against the current, [1]
- (ii) with the current. [1]
- (b) Find an expression for the time required to travel 120 km
- (i) against the current, [1]
- (ii) with the current. [1]
- (c) If the boat takes 40 minutes longer to travel against the current than it takes to travel with the current, write down an equation in x and show that it can be expressed as $x^2 + 360x - 3025 = 0$. [3]
- (d) Solve the equation $x^2 + 360x - 3025 = 0$, giving both answers correct to two decimal places. [4]
- (e) Find the time taken to travel 80 km with the current. [2]

5



- (a) Using the information in the diagram above, find the equation of the line l . [2]
- (b) If the line l cuts the y and x -axes at point C and D respectively, find the coordinates of C and of D . [2]
- (c) Find the area of triangle COD where O is the origin. [1]
- (d) Find the perpendicular distance of O to CD . [3]

- 6 The diagram shows 2 similar metallic containers whose base radii are 10 cm and 15 cm respectively.



- (a) Find the ratio of the heights of the two containers. [1]
- (b) If the capacity of the big container is $3\,375\text{ cm}^3$, find the capacity of the small container. [2]
- (c) If the cost of the material used to paint the smaller container is \$15, find the cost to paint the big container. [2]

7

Figure 1 shows a vertical cross section of a funnel. The funnel was made by cutting off the tip of a circular cone and joining the remaining part to a cylindrical tube. The length of the cylindrical tube is 6 cm and its diameter is 1.5 cm. The cone originally had a height of 8 cm and a base diameter of 12 cm.

Figure 2 shows the vertical cross section of the tip of the cone that was cut off. It has a height of 1 cm and a base diameter of 1.5 cm.

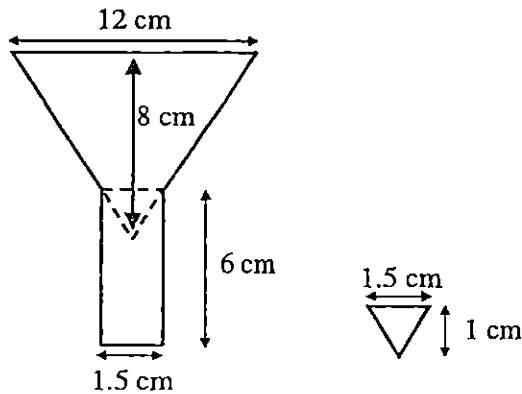


Figure 1

Figure 2

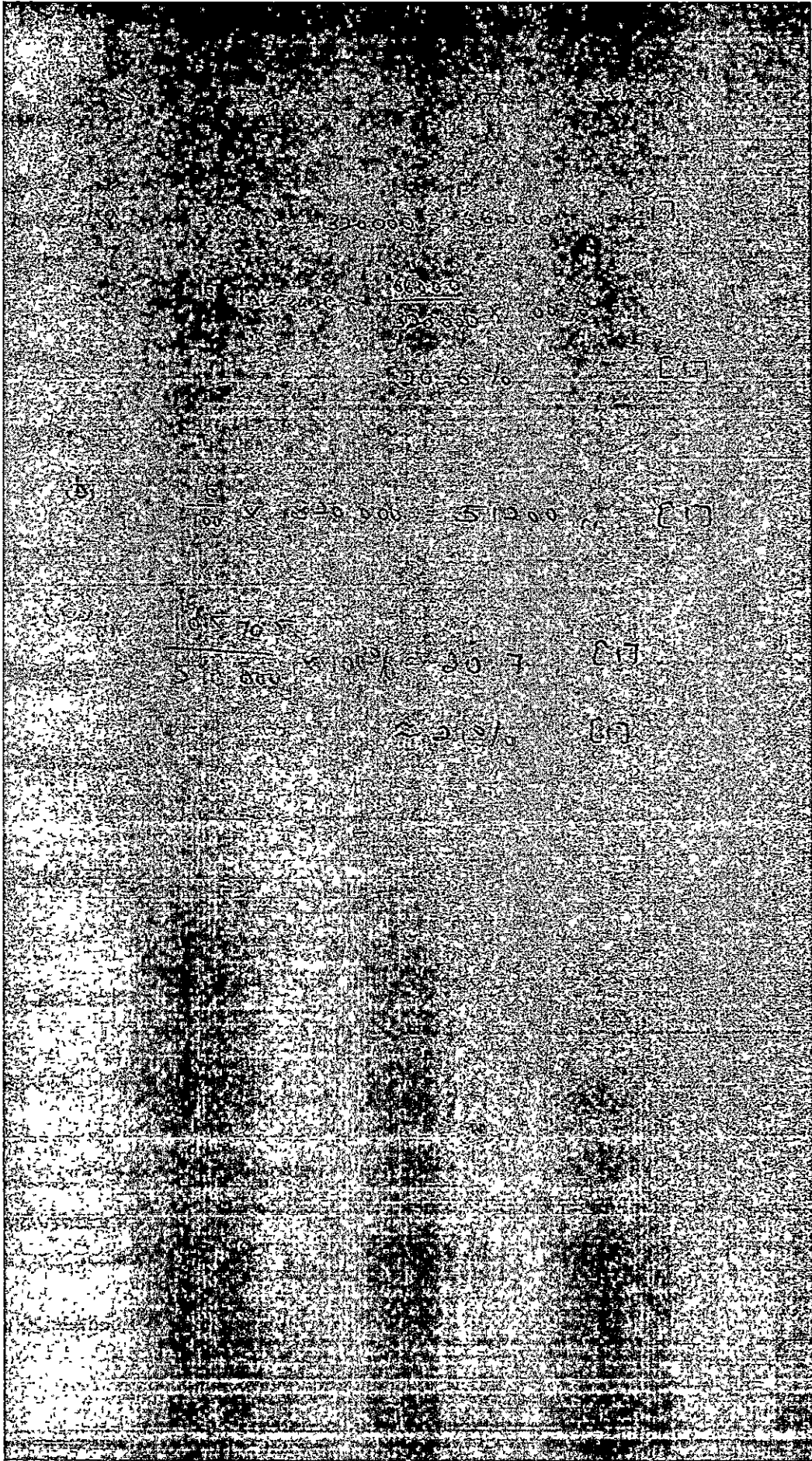
Calculate

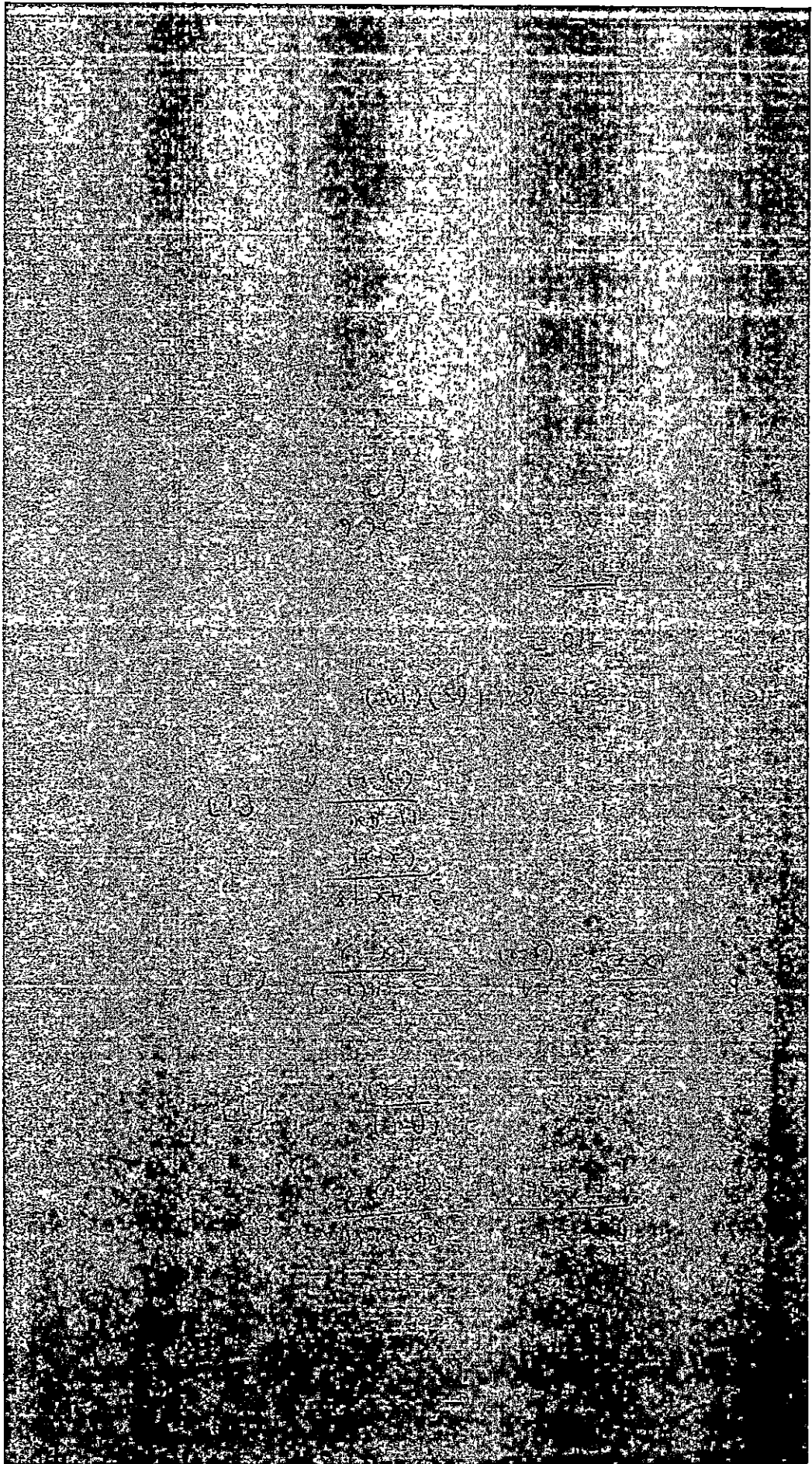
- (a) the volume of the cone before it was cut, [1]
- (b) the volume of the cone shown in Figure 2, [1]
- (c) the volume of the funnel, [3]
- (d) the total external surface area of the funnel. [4]

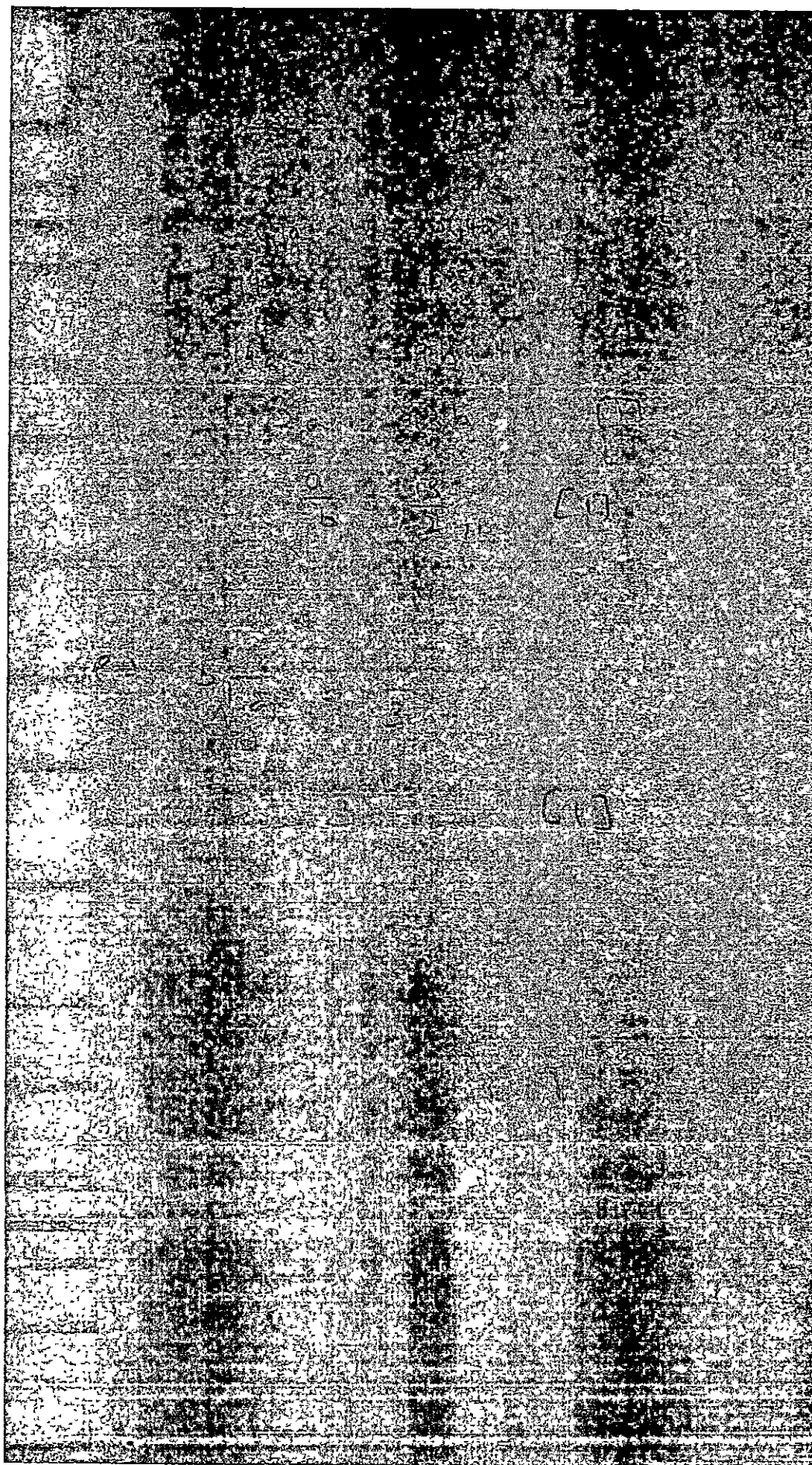
(Take $\pi = 3.142$)

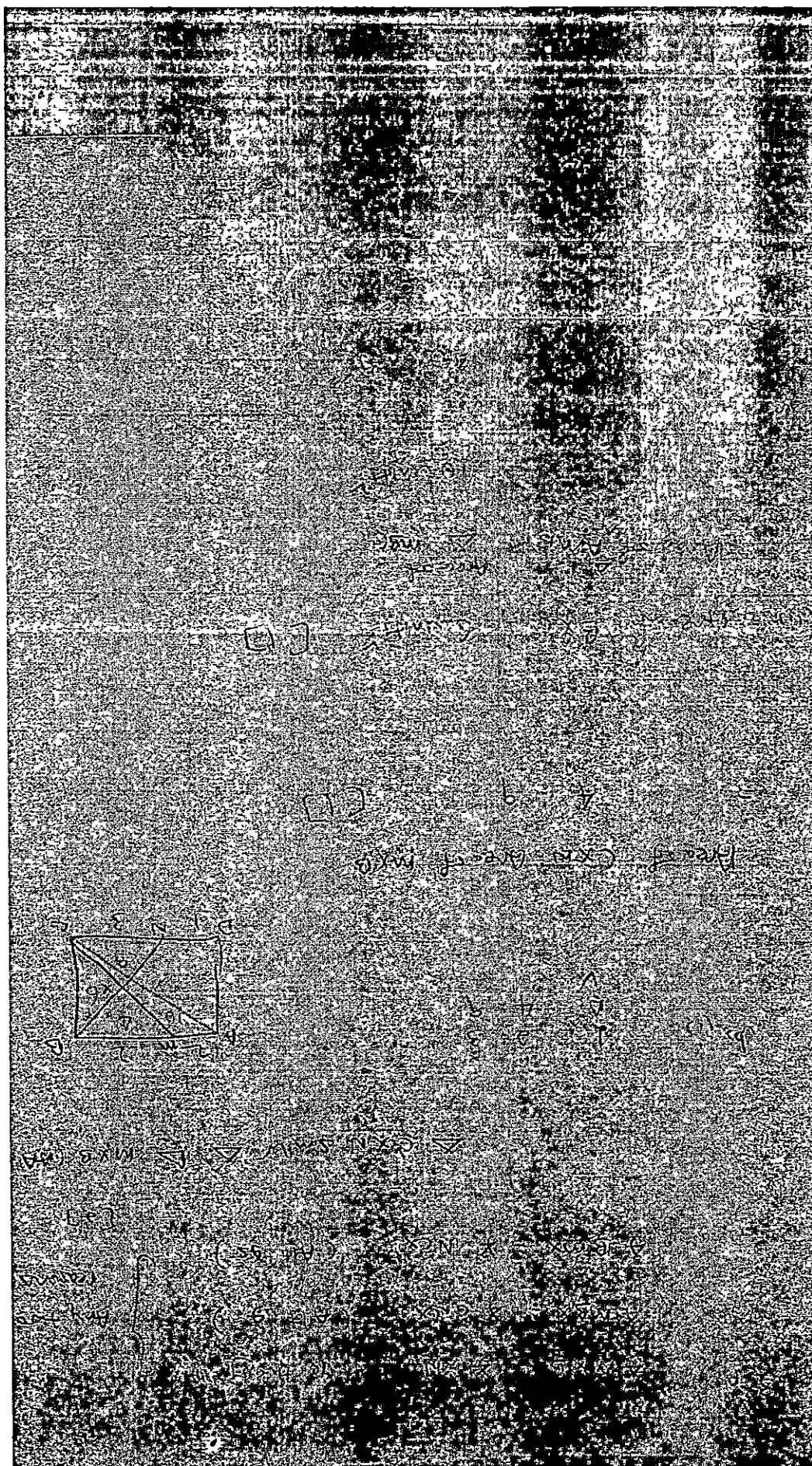
(Give your answers correct to 3 significant figures)

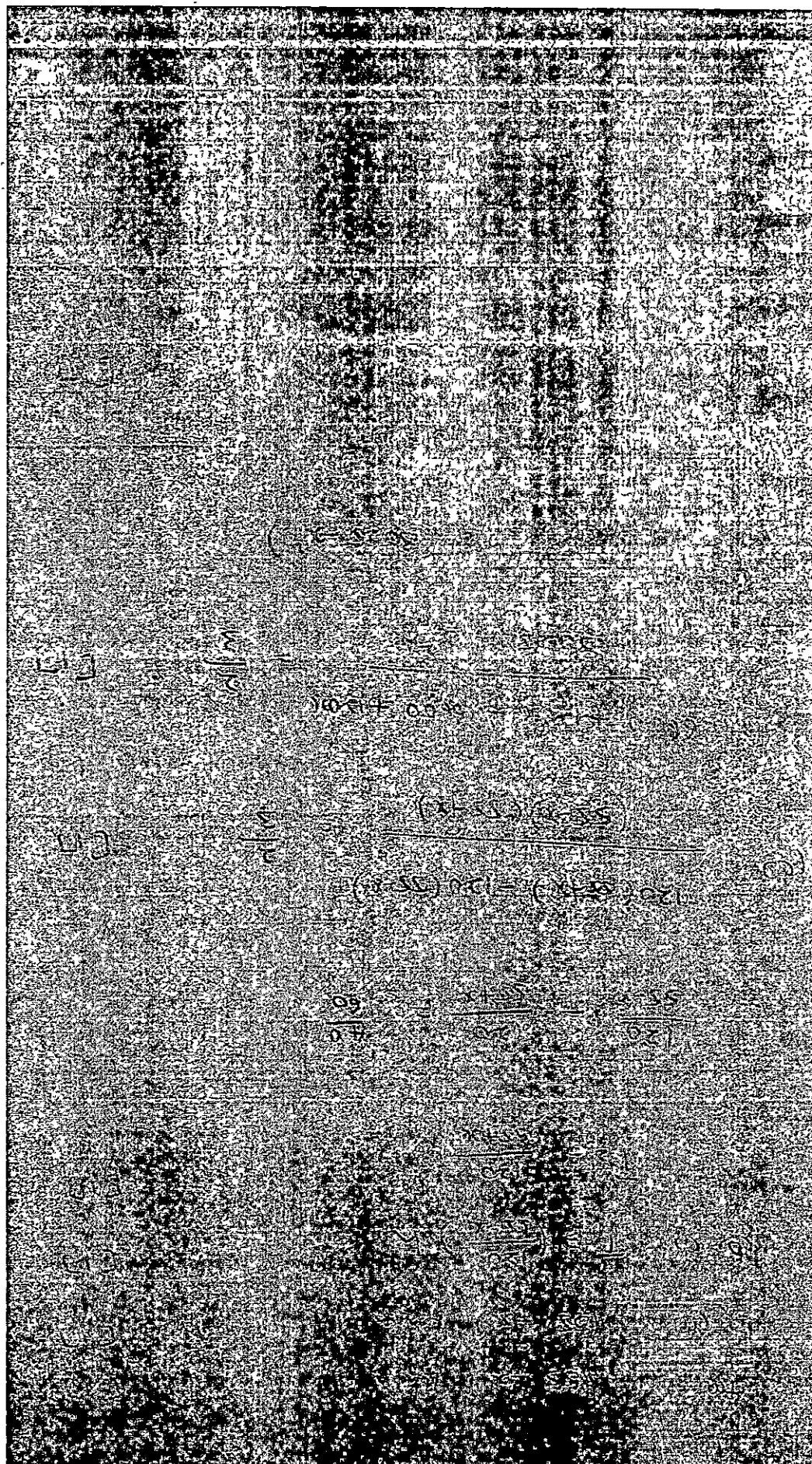
End of Paper 2

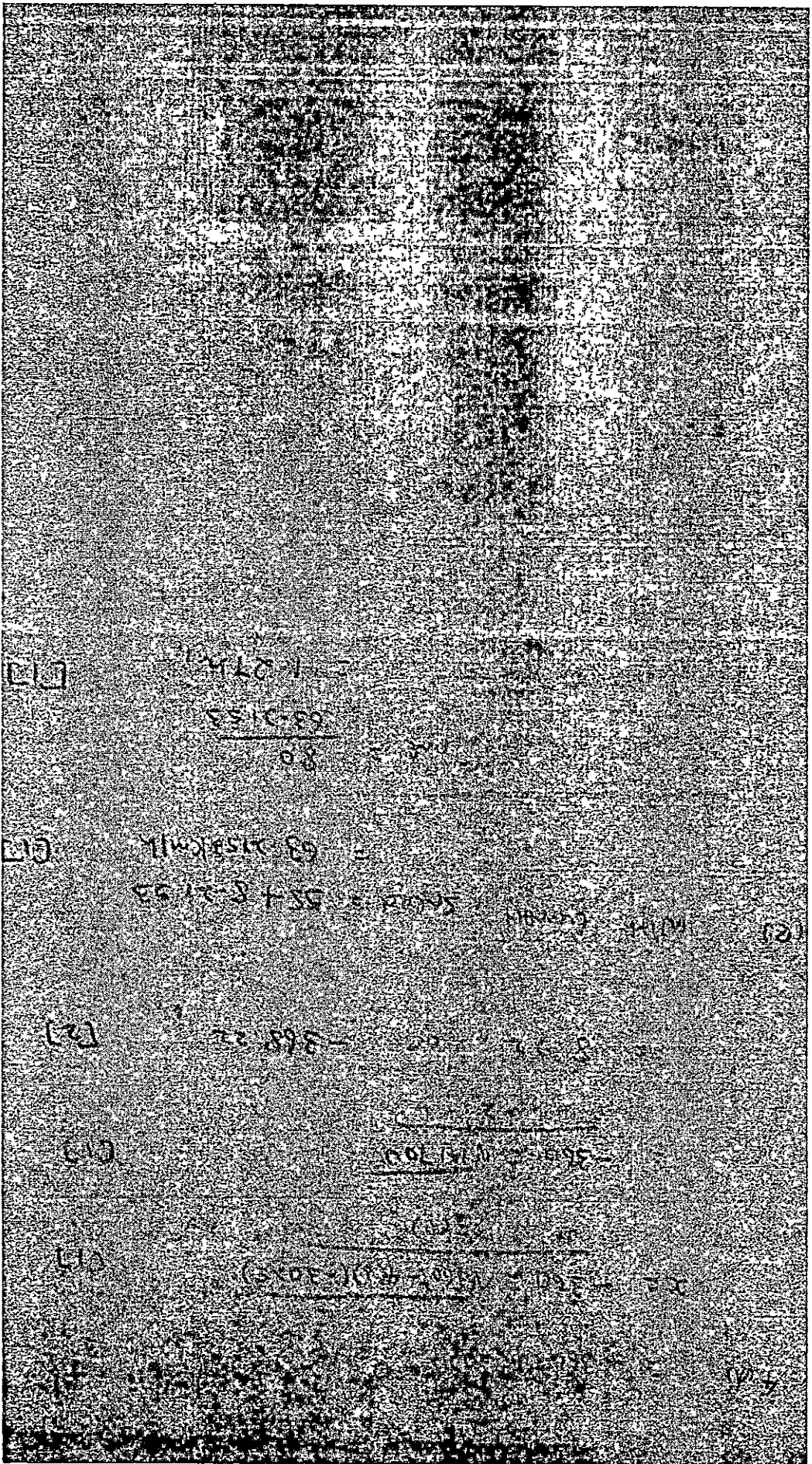


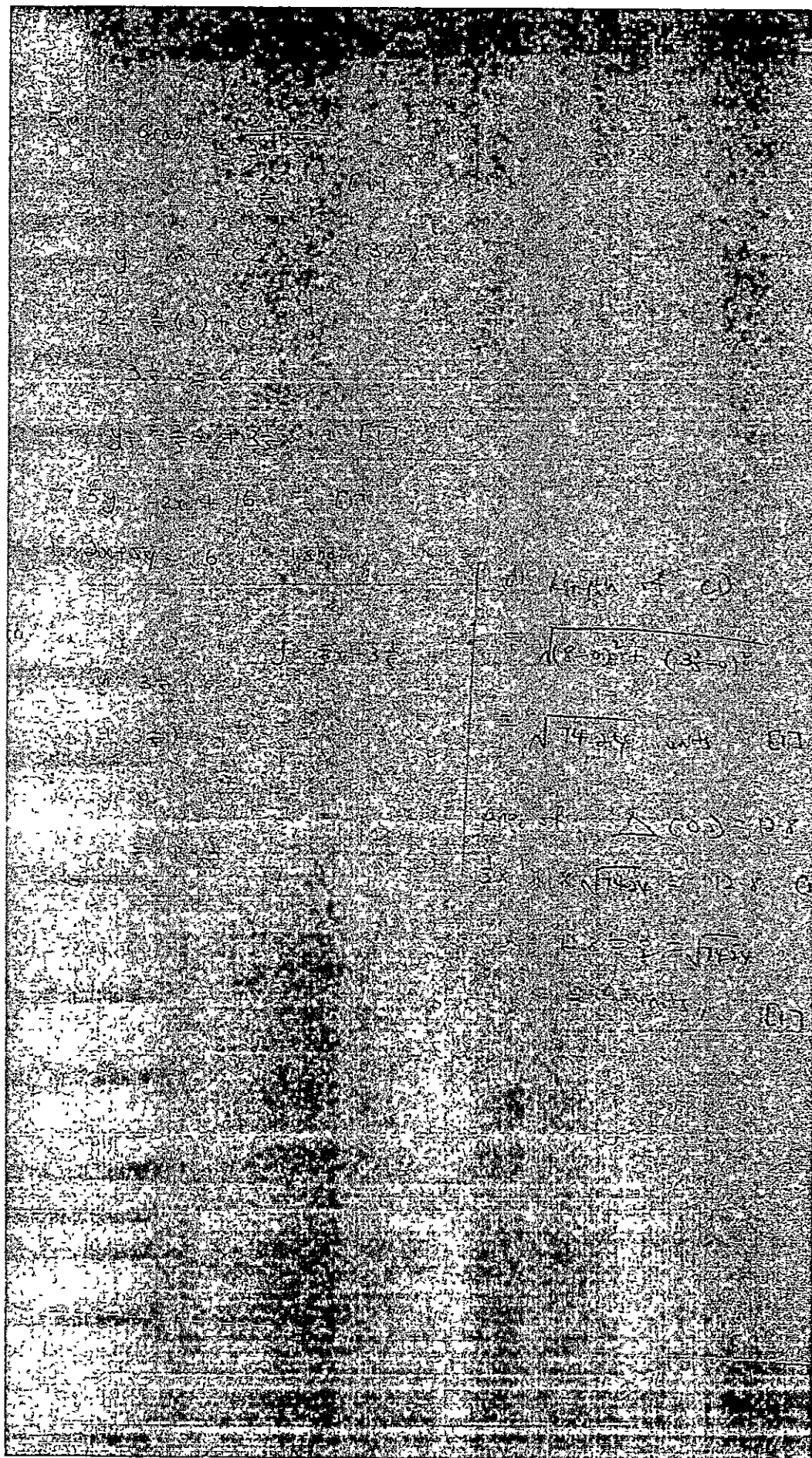












03

017

4 { 200 000

2 000 000

017

2 000 000

0 " 3 000 = 1 000 000 (b)

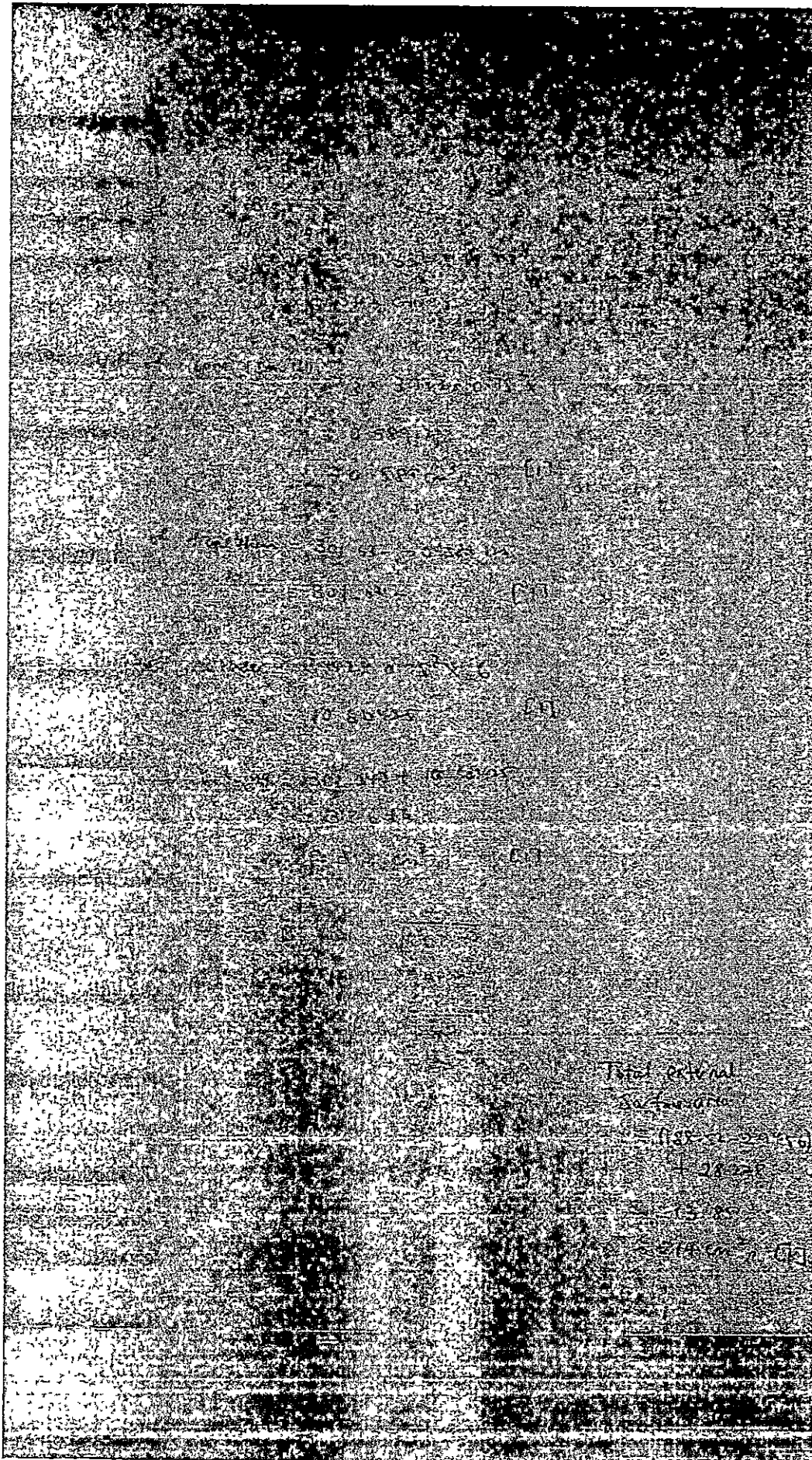
1 000 000

1 000 000

1 000 000

1 000 000

1 000 000



Total external
surface area
188.4 sq. ft.
+ 24.25
= 212.65
13.8
= 226.45