

Name:	Class:	Class Register Number:
-------	--------	------------------------



中正中学

CHUNG CHENG HIGH SCHOOL (MAIN)

Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School
 Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School
 Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School
 Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School
 Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School Chung Cheng High School

**PRELIMINARY EXAMINATION 2026
SECONDARY 4**

MATHEMATICS

4052/02

Paper 2

Tuesday 18 August 2026

2 hours 15 minutes

Candidates answer on the Question Paper

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this page.
 Write in dark blue or black pen.
 You may use an HB pencil for any diagrams or graphs.
 Do not use paper clips, glue or correction fluid.

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

If working is needed for any question it must be shown with the answer. Omission of essential working will result in loss of marks. The total number of marks for this paper is 90.

The use of an approved scientific calculator is expected, where appropriate. 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.

For Examiner's Use	
Question Number	Marks Obtained
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

This document consists of 22 printed pages and 2 blank pages.

Mathematical Formulae*Compound interest*

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

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

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

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

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

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

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

TURN OVER FOR QUESTION 1

1 (a) It is given that $y = \frac{6}{a} - \frac{a}{x}$.

(i) Express x in terms of a and y .

Answer $x = \dots\dots\dots$ [2]

(ii) Given that $x : y : a = 1 : 2 : 3$, find the value of y .

Answer $y = \dots\dots\dots$ [3]

- (b) Solve the equation $x^2 + 10x - 7 = 0$ by **completing the square**.
Give your solutions correct to 1 decimal place.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [4]

- 2 (a) Mei invests a sum of money at a compound interest of $r\%$ per annum.
At the end of 4 years, the value of her investment has increased by 25%.
Find the value of r .

Answer $r = \dots\dots\dots$ [3]

- (b) John borrows \$15 000 from a Singapore bank for 3 years to pay for an overseas course in France that costs €9800.

The exchange rate between Singapore dollars and euros is \$1 = €0.625.

The bank charges simple interest at a rate of 5% per annum.

- (i) Show with clear working whether the amount borrowed is sufficient to pay for the course fee.

Answer

.....
..... [1]

- (ii) Calculate the total amount John has to repay the Singapore bank.

Answer \$ [2]

- (c) In a number sequence, the sum of the first n terms is given by $S_n = n^2 + 3n$.
- (i) Find the sum of the 15th to the 30th terms.

Answer [1]

- (ii) By finding S_{n-1} , show that all the terms in the number sequence are always even.

Answer

.....
 [3]

- (iii) $T_3, T_6, T_9, \dots$ is a new sequence is formed by taking every 3rd term of the original sequence.

Find an expression, in terms of m , to represent the m^{th} term of the new sequence.

Answer [2]

- 3** A weather station recorded the temperature of a city, T in degrees Celsius, at various times between 8.30 p.m. on 15 July and 3.30 a.m. on 16 July.

Let t be the time, in hours, measured relative to midnight at the start of 16 July.

Some of the recorded temperatures are shown in the table below.

t	-3.5	-3	-2	-1	0	1	2	2.5	3.5
T	-3.9	0	3.75	3.6	1.35	-1.2	-2.25	-1.65	2.93

For example: $t = -3$ corresponds to 9 p.m. on 15 July.

The temperature can be modelled by the equation $T = k(t+3)(t-p)(t-q)$ where k , p and q are constants.

- (a)** On the grid opposite, plot the points given in the table and join them with a smooth curve. [3]

- (b)** Using your graph, estimate the values of p and q .

Answer $p = \dots\dots\dots$

$q = \dots\dots\dots$

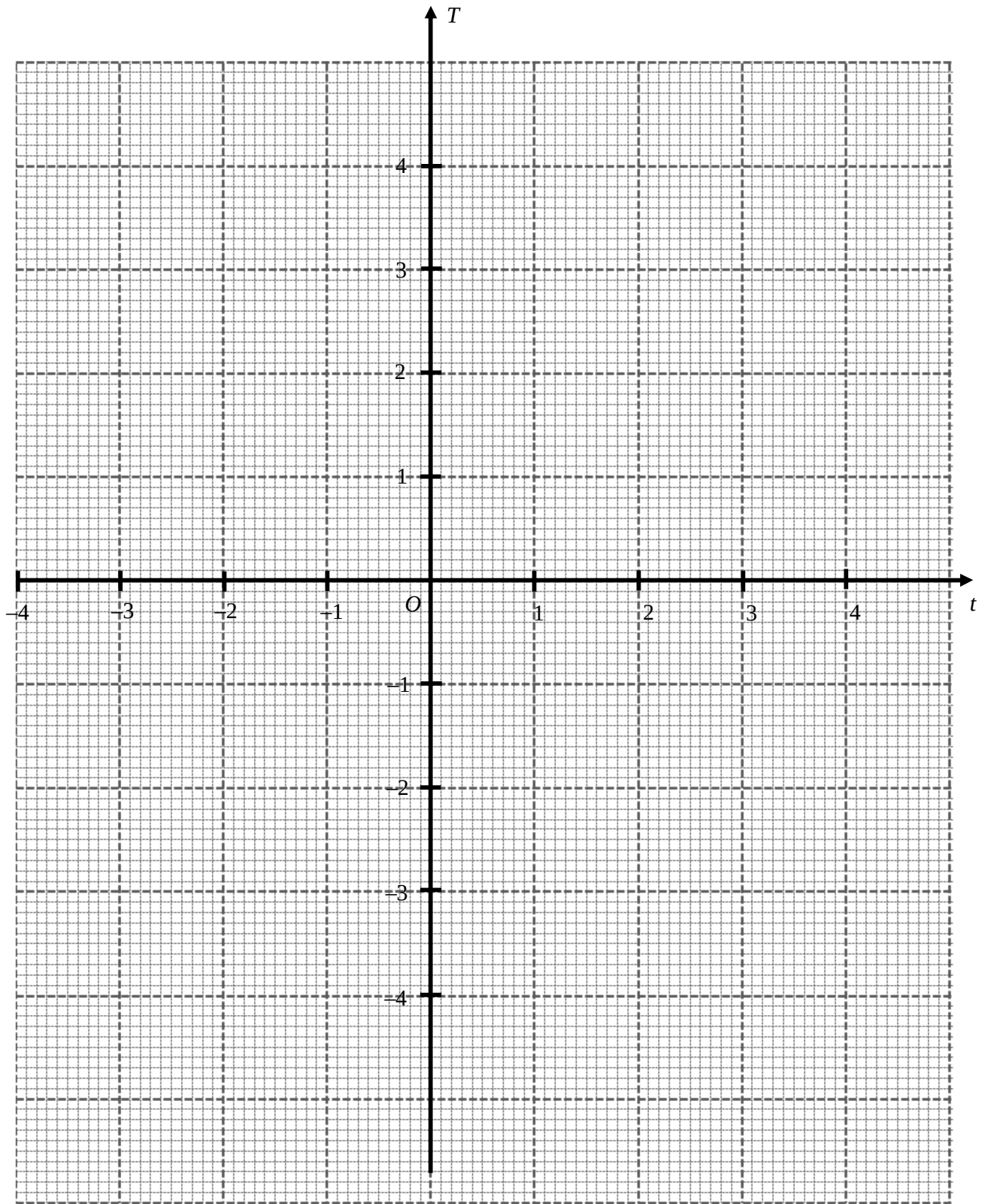
[2]

- (c)** By drawing a tangent, find the gradient of the curve at $t = -2$ and state the units in your answer.

Answer $\dots\dots\dots$ [3]

- (d)** A warning is issued whenever $T \leq -1.5$. Using your graph, estimate the duration for which the warning would have been active.

Answer $\dots\dots\dots$ hours [1]



- 4 A fruit wholesaler collects information about the masses of pears supplied by Farm A and Farm B.

The stem-and-leaf diagram shows the masses of a sample of 20 pears from Farm A.

15		5	8						
16		0	2	3	5	7	9		
17		0	1	2	4	4	5	6	8
18		0	2	3	5				

Key: 15 | 8 means 158 grams

Find

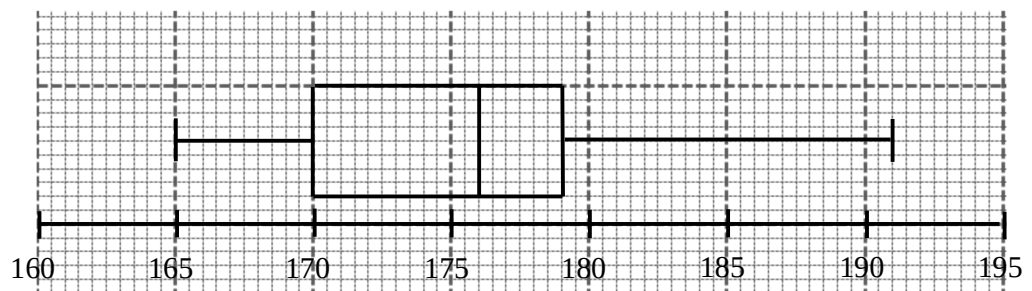
- (a) the median,

Answer grams [1]

- (b) the interquartile range.

Answer grams [2]

The box-and-whisker diagram shows the masses of 20 pears sampled from Farm B.



- (c) The fruit wholesaler examines the box-and-whisker diagram and comments:
 “A higher proportion of Farm B's pears are heavier, since its right whisker is longer than its left whisker”.

Comment on whether the wholesaler's comment is correct.

Answer

.....

.....

..... [2]

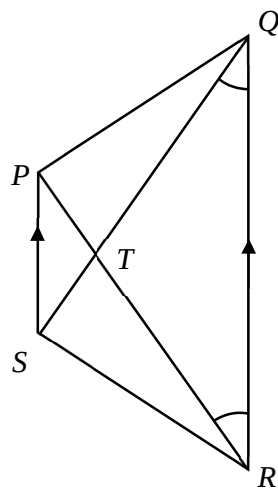
- (d) Recommend which farm the wholesaler should purchase from.

Explain and justify your choice with reference to appropriate statistical measures.

Answer

.....
.....
.....
..... [3]

- 5 (a) $PQRS$ is a trapezium where PS is parallel to QR .
 QS intersects PR at T .
 Angle $TQR = \text{angle } QRT$.



Show that triangles PQT and SRT are congruent.

Answer

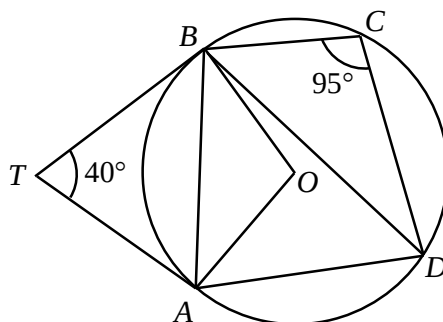
.....

.....

.....

[5]

(b)



In the diagram, A , B , C and D are points on a circle, centre O .

The tangents at A and B meet at T .

Angle $ATB = 40^\circ$ and angle $BCD = 95^\circ$.

Find, giving reasons for each step of your working,

(i) angle BOA ,

Answer[2]

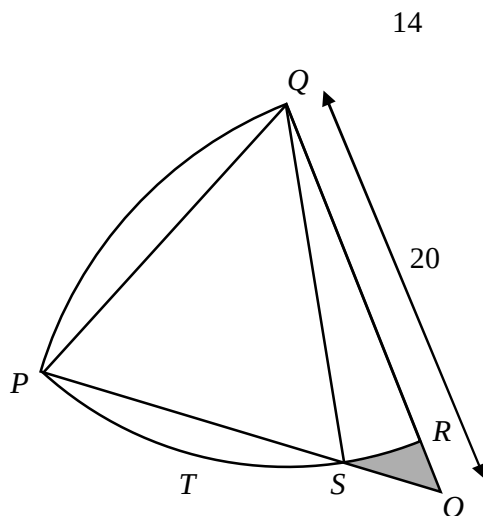
(ii) angle ACB ,

Answer[2]

(iii) angle OAD .

Answer [3]

6



In the diagram, OPQ is a sector of a circle, centre O and radius 20 cm.

$PTS R$ is an arc of another circle, centre Q .

The length of arc PQ is 14.8 cm.

- (a) Show that angle $POQ = 0.74$ radians. [1]

Answer

- (b) Show that $QS = 14.5$ cm. [2]

Answer

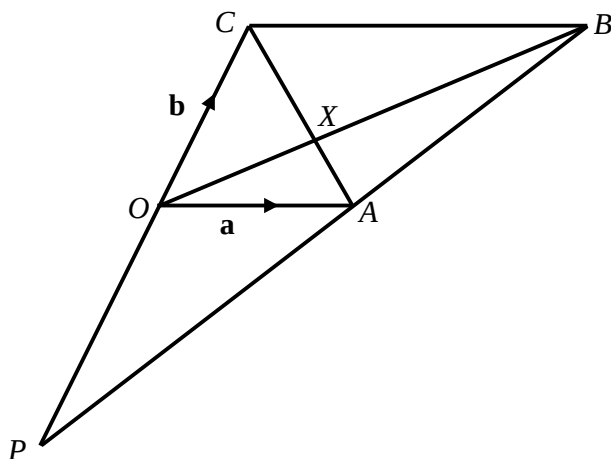
- (c) Find angle SQR .

Answer radians [3]

- (d) Find the area of the shaded region.

Answer cm^2 [3]

- 7 In the diagram, $OABC$ is a quadrilateral where the diagonals OB and AC intersect at X .
 $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{b}$ and $\overrightarrow{OB} = 2\mathbf{a} + \mathbf{b}$. The lines BA and CO are produced to meet at P .



- (a) Find $\overrightarrow{CB}$, giving your answer in terms of $\mathbf{a}$ and/or $\mathbf{b}$.

Hence, explain why $ABCO$ is a trapezium.

Answer

Answer $\overrightarrow{CB} = \dots\dots\dots$ [3]

- (b) Giving your answers in terms of $\mathbf{a}$ and/or $\mathbf{b}$, find

- (i) $\overrightarrow{OX}$,

Answer $\overrightarrow{OX} = \dots\dots\dots$ [1]

- (ii) $\overrightarrow{AB}$.

Answer $\overrightarrow{AB} = \dots\dots\dots$ [1]

- (c) Find the ratio of area of triangle OAX : area of triangle OAC .

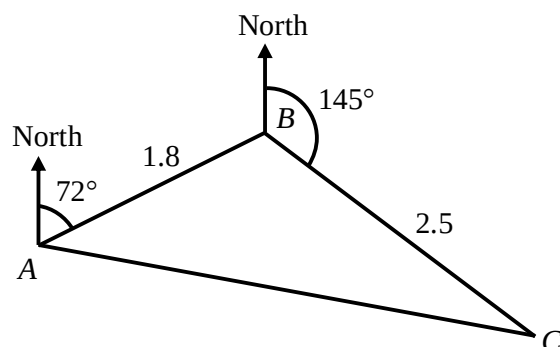
Answer [1]

- (d) Using vector method, find $\overrightarrow{OP}$ and show that O is the midpoint of PC .

Answer

.....
 [4]

- 8 An orienteering course has three checkpoints, A , B and C , on level ground. The bearing of B from A is 072° and the bearing of C from B is 145° . $AB = 1.8\text{ km}$ and $BC = 2.5\text{ km}$.



- (a) Find the distance AC .

Answer km [3]

- (b) Find the bearing of C from A .

Answer [2]

- (c) Find the shortest distance from B to AC .

Answer km [2]

- (d) A boy walks along the path AC . He stops at a point that is closest to B and releases a signal flare that rises vertically.

Find the angle of elevation of the signal flare from point A when it reaches a height of 250 m.

Answer [3]

- 9 A coastal city has an existing sea dike to protect its low-lying land from rising sea levels. The dike has a uniform trapezoidal cross-section, $ABCD$, as shown in **Diagram (a)**. Its crest, BC , is 8 m wide and its base, AD , is 38 m wide. The crest is 6 m above the current mean sea level. The seaward face rises over a horizontal distance of 18 m from A to F .

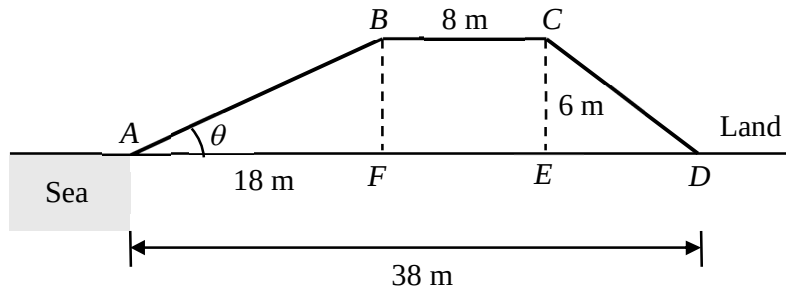


Diagram (a)

- (a) Find the angle, θ , that the seaward face of the dike makes with the horizontal.

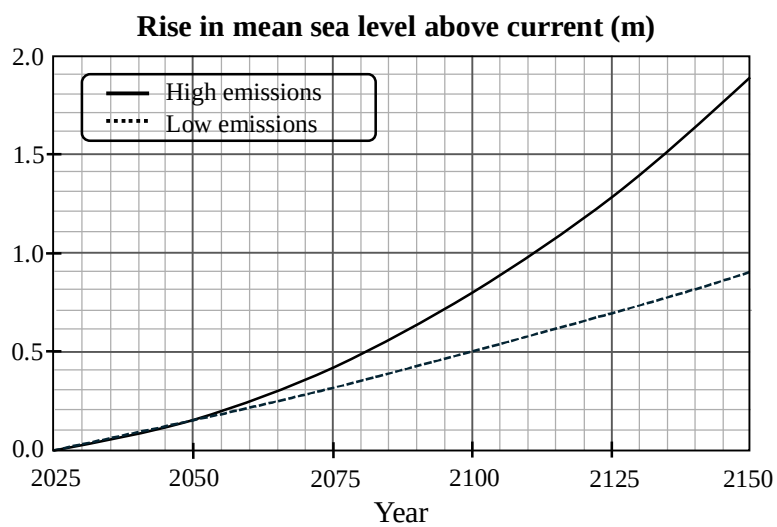
Answer [1]

The dike extends 10 km along the coast and has the same cross-section throughout its length.

- (b) Find the volume of fill used to build the 10 km dike. Leave your answer in cubic metres.

Answer m^3 [2]

The graph below shows the projected rise in mean sea level (above the current mean sea level) under two global emission scenarios, up to the year 2150.



For safety, engineers require the dike crest to remain at least 4.5 m above the projected mean sea level. The width of the crest and gradients of the sloping faces remain unchanged as shown in **Diagram (b)**.

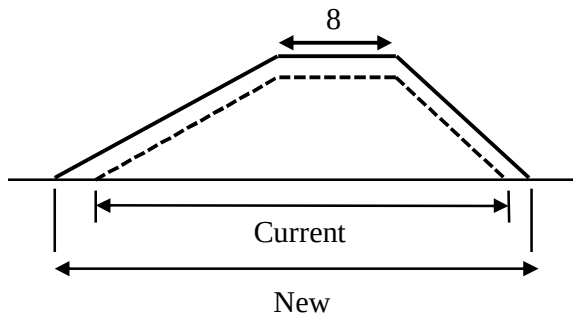


Diagram (b)

Cost information

- Fill (sand): \$25 per cubic metre.
- Sea-level rise causes erosion of the seaward face. Therefore, approximately 2000 m^3 of sand is needed for renourishment in the first year, increasing steadily to 40000 m^3 by the 50th year.
- Design life of the dike: 50 years

You are an engineer preparing a budget proposal for the city council to protect the coast. The budget must include:

- the cost of additional fill required to raise the existing dike so that it meets the safety requirement in the year 2150 under the high-emissions scenario; and
 - the cost of maintaining the dike by replacing fill lost through erosion over the following 50 years.
- (c) Using the graph and the cost information provided, recommend a budget for the council to approve. Justify your recommended budget with clear workings.

Answer

.....

[8]

Continue for Question 9(c)

BLANK PAGE