



NETAJI SUBHAS OPEN UNIVERSITY

POST-GRADUATE COURSE

Assignment — June-2020/Dec.-2020

COMMERCE

Paper - VIII : Quantitative Techniques

QUESTION PAPER CUM ANSWER BOOKLET

(Full Marks : 50)

(Weightage of Marks : 20%)

Special credit will be given for precise and correct answer. Marks will be deducted for spelling mistakes, untidiness and illegible handwriting. The figures in the margin indicate full marks.

Name (in Block Letter) :

Enrolment No.

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Study Centre Name : Code :

To be filled by the Candidate	Serial No. of question answered																				TOTAL	
For Evaluator's only	Marks awarded																					

Q.P. Code : **PA/5/VIII**

PG-COM.-AP-17084

Signature of Evaluator with Date



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POST-GRADUATE COURSE

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COMMERCE

Paper - VIII : Quantitative Techniques

STUDENT'S COPY

Name (in Block Letter) :

Enrolment No.

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Received Answer Booklet
Signature with seal by the Study-Centre

**জরুরি নির্দেশ / Important Instruction**

আগামী শিক্ষাবর্ষান্ত পরীক্ষায় (T.E. Exam.) নতুন ব্যবস্থা অর্থাৎ প্রশ্নসহ উত্তর পুস্তিকা (QPAB) প্রবর্তন করা হবে। এই নতুন ব্যবস্থার সঙ্গে পরীক্ষার্থীদের অভ্যস্ত করার জন্য বর্তমান অনুশীলন পত্রে নির্দেশ অনুযায়ী প্রতিটি প্রশ্নের উত্তর নির্দিষ্ট স্থানেই দিতে হবে।

New system i.e. Question Paper Cum Answer Booklet (QPAB) will be introduced in the coming Term End Examination. To get the candidates acquainted with the new system, assignment answer is to be given in the specified space according to the instructions.

**Detail schedule for submission of assignment for the
PG Term End Examination June-2020/Dec.-2020**

1. Date of Publication : 20/06/2020
2. Last date of Submission of answer script by the student to the study centre : 19/07/2020
3. Last date of Submission of marks by the examiner to the study centre : 16/08/2020
4. Date of evaluated answer scripts distribution by the study centre to the students (Students are advised to check their assignment marks on the evaluated answer scripts and marks lists in the study centre notice board. If there is any mismatch / any other problems of marks obtained and marks in the list, the students should report to their study centre Co-ordinator on spot for correction. The study centre is advised to send the corrected marks, if any, to the COE office within five days. No change / correction of assignment marks will be accepted after the said five days.) : 23/08/2020
5. Last date of submission of marks by the study centre to the Department of C.O.E. on or before : 31/08/2020

এখানে কিছু লিখবেন না

Do Not Write Anything Here



MODULE - I

Answer any *two* questions :

$$12\frac{1}{2} \times 2 = 25$$

1. a) A firm produces three products *A*, *B* and *C*. It uses two types of raw materials *I* and *II* of which 5000 and 7500 units, respectively, are available. The raw material requirements per unit of the products are given below :

Raw Material	Requirement per unit of product		
	A	B	C
I	3	4	5
II	5	3	5

The labour time for each unit of Product *A* is twice as that of Product *B* and three times that of Product *C*. The entire labour force of the firm can produce the equivalent of 3000 units. The minimum demand for the three products are 600, 650 and 500 units respectively. Also, the ratio of the number of units produced must be equal to 2 : 3 : 4. Assuming the profits per unit of *A*, *B* and *C* are 50, 50 and 80, respectively, formulate the problem as a linear programming problem in order to determine the number of units of each product which will maximise the profit. $6\frac{1}{2}$

- b) Solve graphically :

$$\text{Maximise } Z = 10x_1 + 15x_2$$

$$2x_1 + x_2 \leq 26$$

$$2x_1 + 4x_2 \leq 56$$

$$x_1 - x_2 \leq -5$$

$$x_1 \leq 4 : x_2 \geq 2, x_1, x_2 \geq 0.$$

6

(Graph Sheet is provided on Page No. **23**)

2. a) Write the dual of the following :

$$\text{Minimise } Z = 5x_1 - 6x_2 + 4x_3$$

$$\text{subject to } 3x_1 + 4x_2 + 6x_3 \geq 9$$

$$x_1 + 3x_2 + 2x_3 \geq 5$$

$$7x_1 + 2x_2 - x_3 \leq 10$$

$$x_1 - 2x_2 + 4x_3 \geq 4$$

$$2x_1 + 5x_2 - 3x_3 = 3$$

$$x_1, x_2, x_3 \geq 0.$$

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- b) Solve the following by simplex method :

$$\text{Minimise } Z = 6x_1 + 20x_2$$

$$\text{subject to } 2x_1 + x_2 \leq 32$$

$$3x_1 + 4x_2 \leq 80$$

$$x_1 \geq 8$$

$$x_2 \geq 10.$$

 $7\frac{1}{2}$



3. a) The simplex tableau for a maximisation problem of linear programming is given as follows :

<i>Product Mix.</i>	X_j	X_1	X_2	S_1	S_2	<i>Quantity</i>
C_j						
5	X_2	1	0	1	0	10
0	S_2	1	1	-1	1	3
	C_j	4	5	0	0	50
	Z_j	5	5	5	0	
	$C_j - Z_j$	-1	0	-5	0	

Answer the following questions, giving reasons in brief :

- i) Is this solution an optimal ?
- ii) Are there more than one optimal solution ?
- iii) Is this solution degenerate ?
- iv) Is this solution feasible ?
- v) If S_1 is slack in machine A (in hours / week) and S_2 is slack in machine B (in hours/week), which of these machines is being used to the full capacity when producing according to the solution ?
- vi) A customer would like to have one unit of product x_1 and is willing to pay in excess of the normal price in order to get it. How much should the price be increased in order to ensure no reduction of profits ?
- vii) How many units of the two products x_1 and x_2 are being produced according to this solution and what is the total profit ?

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b) Solve the following problem using transportation, obtaining the initial feasible solution by VAM. The cell entries in the table are unit costs.

From	To					Supply
	1	2	3	4	5	
1	80	69	103	64	61	12
2	47	100	72	65	40	16
3	16	103	87	36	94	20
4	86	15	57	19	25	8
5	27	20	72	94	19	8
Demand	16	14	18	6	10	



4. a) A company plans to assign 5 salesmen to 5 districts in which it operates. Estimate of sales revenue in thousands of rupees for each salesman in different districts are given in the following table. In your opinion, what should be the placement of the salesman if the objective is to maximise the expected sales revenue ?

Salesman	Districts				
	D_1	D_2	D_3	D_4	D_5
S_1	40	46	48	36	48
S_2	48	32	36	29	44
S_3	49	35	41	38	45
S_4	30	46	49	44	44
S_5	37	41	48	43	47

 $6\frac{1}{2}$

- b) A manufacturer of a certain component has the following estimates of the demand for its product :

<i>Period</i>	1	2	3	4
<i>Demand</i>	50	70	85	75

The regular production capacity for each period is 60 units while with overtime working, and additional of up to 20 units can be produced in each period. The unit cost of production in regular time is worked out to be Rs. 6 whereas it would cost Rs. 10 per unit for the items manufactured during overtime. You may assume that the costs would be identical in all the periods. Any production in excess of the requirement in the current period may be held at a cost of Rs. 3 per unit per period. No holding cost is involved if a unit is sold in the period in which it is produced. Formulate the problem as a transportation problem.

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First Answer :



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Second Answer :



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MODULE - II

Answer any *two* questions :

$$12\frac{1}{2} \times 2 = 25$$

5. a) A project comprises 9 activities. The following table indicates the activities and their duration :

<i>Activity</i>	<i>Preceding Activities</i>	<i>Duration</i>
A	—	3
B	—	5
C	—	4
D	A	2
E	B	3
F	C, B	9
G	D, E	8
H	B	7
I	H, F	9

- i) Prepare the network diagram for the project.
 ii) Carry out the critical path computations and hence identify the activities on the critical path. Calculate total float and free float for all the activities and explain their meaning in the context of this problem. $6\frac{1}{2}$

- b) i) Represent the following game problem as a linear programming problem :

	B_1	B_2	B_3
A_1	3	- 1	- 3
A_2	- 2	4	5

- ii) Solve the above game problem graphically. $3 + 3$
 (Graph Sheet is provided on Page No. **25**)

6. A management company has decided to run a short management training course on project management. The project manager identified the key activities, the key required for the project is shown in the following table :

<i>Activity</i>	<i>Duration</i>	<i>Preceding Activities</i>
A	4	—
B	2	A
C	6	B
D	6	A
E	2	C, E
F	1	D
G	2	F, G
H	2	H
I	5	G
J	2	I, J
K	3	K

- i) Draw a network diagram for the project.



- ii) Identify the critical path and calculate the estimated duration for the project. Suppose for certain activities there is some uncertainty as to the exact duration and the manager has provided alternative duration figures :

Activity	Optimistic	Most likely	Pessimistic
A	3	4	6
B	2	2	10

- iii) Calculate the time (t_M) that should be allotted to the project so that the probability of completing the project in time t_M is 0.99. [Standard Normal $Z_{0.01} = 2.336$]

$12\frac{1}{2}$

7. a) Discuss different inventory costs. 3
 b) State assumptions of classical EOQ model. 3
 c) A hardware store procures and sells hardware items as follows :

Annual Sales = 20,000 units

Ordering Cost = Rs. 160/- per order

Holding Cost = 20% of the average inventory costs

Unit Cost = Rs. 2/-

Compute optimum economic order quantity, average inventory level, total inventory cost (excluding the capital cost), average inventory cycle when there are 250 working days in a year and number of orders to be placed in a year. $6\frac{1}{2}$

8. a) Metro Shoe Stores stocks a black dress shoe for men that sells at an approximate constant rate of 500 pairs of shoes every 3 months. Metro Shoe Stores' current buying policy is to order 500 pairs each time an order is placed. It costs Metro Shoes Rs. 300 to place an order. The annual holding cost rate is 20%. With the order quantity of 500, Metro Shoes obtains the shoes at the lowest possible unit cost of Rs. 280 per pair. Other quantity discounts offered by the manufacturer are as follows :

Order quantity	Price per unit (Rs.)
0 — 99	360
100 — 199	320
200 — 299	300
300 or more	280

- i) What is the minimum cost order quantity for the shoes ?
 ii) What are the annual savings of your inventory policy over the current policy being used by Metro Shoes ?
 iii) Why is the ordering cost and holding cost incurred annually equal at EOQ level ? $6\frac{1}{2}$



b) Solve the following game :

		<i>Player Q</i>			
		I	II	III	IV
<i>Player P</i>	I	6	4	8	0
	II	6	8	4	8
	III	8	4	8	0
	IV	2	8	0	16

(Graph Sheet is provided on Page No. **27**)

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First Answer :



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Second Answer :



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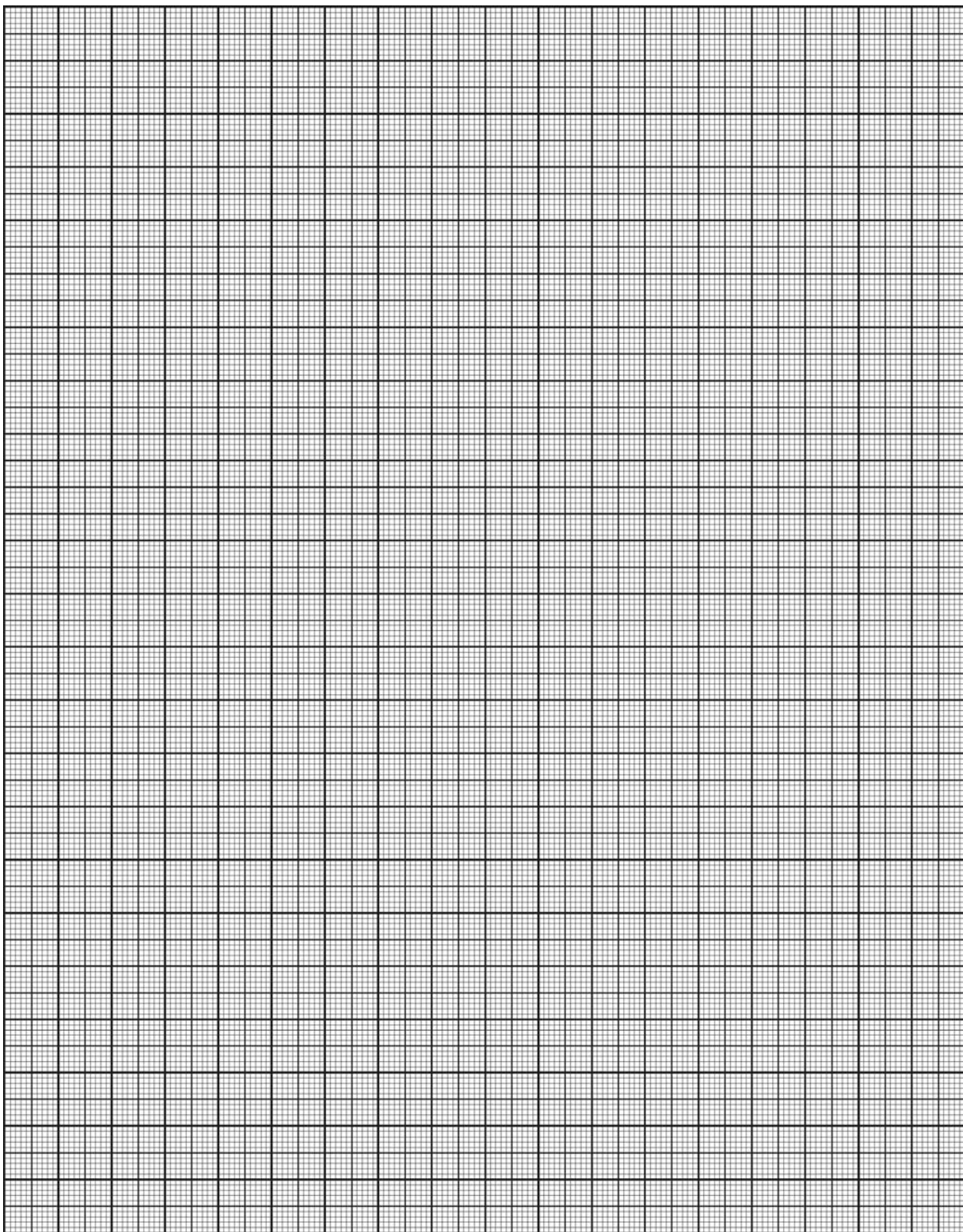
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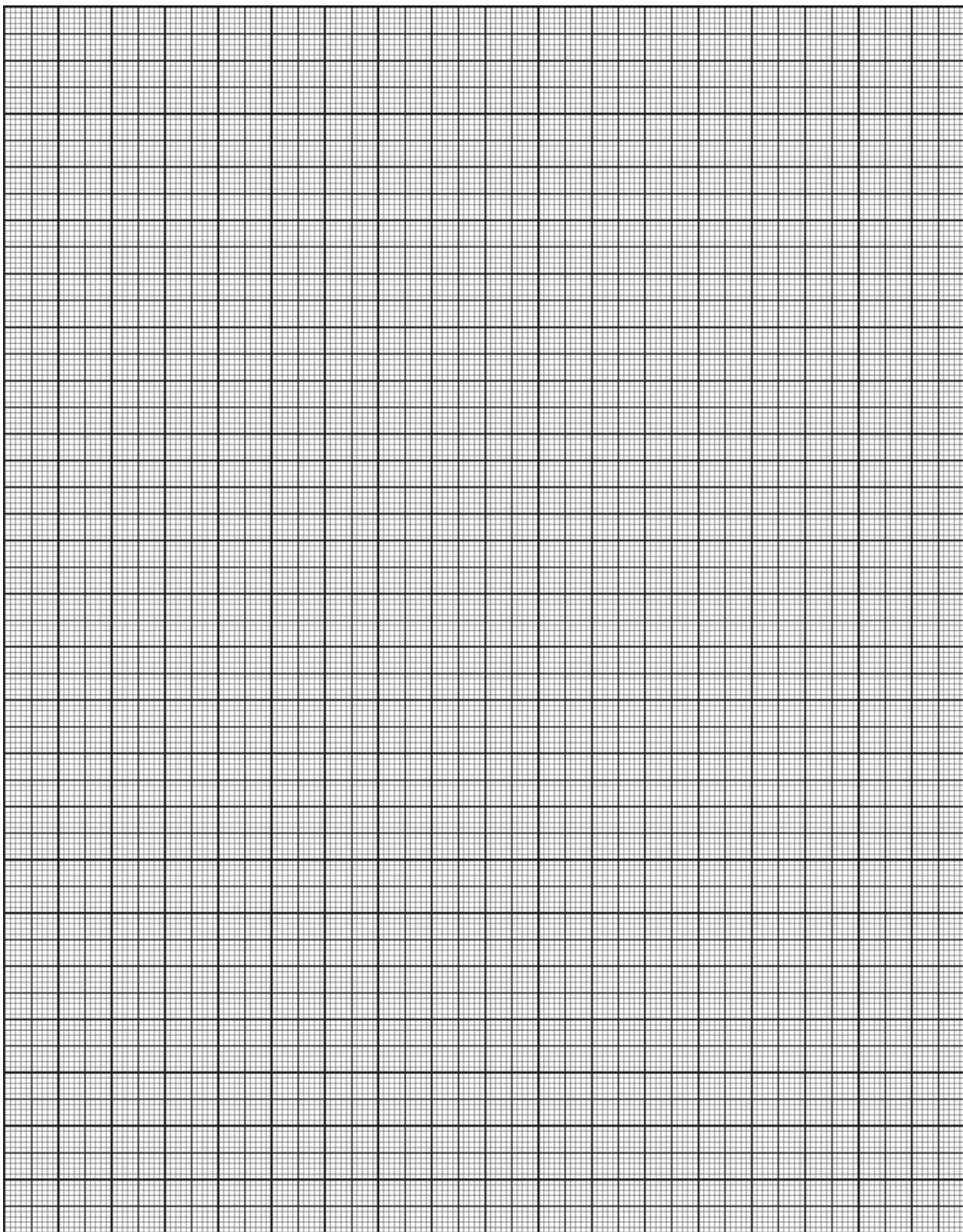




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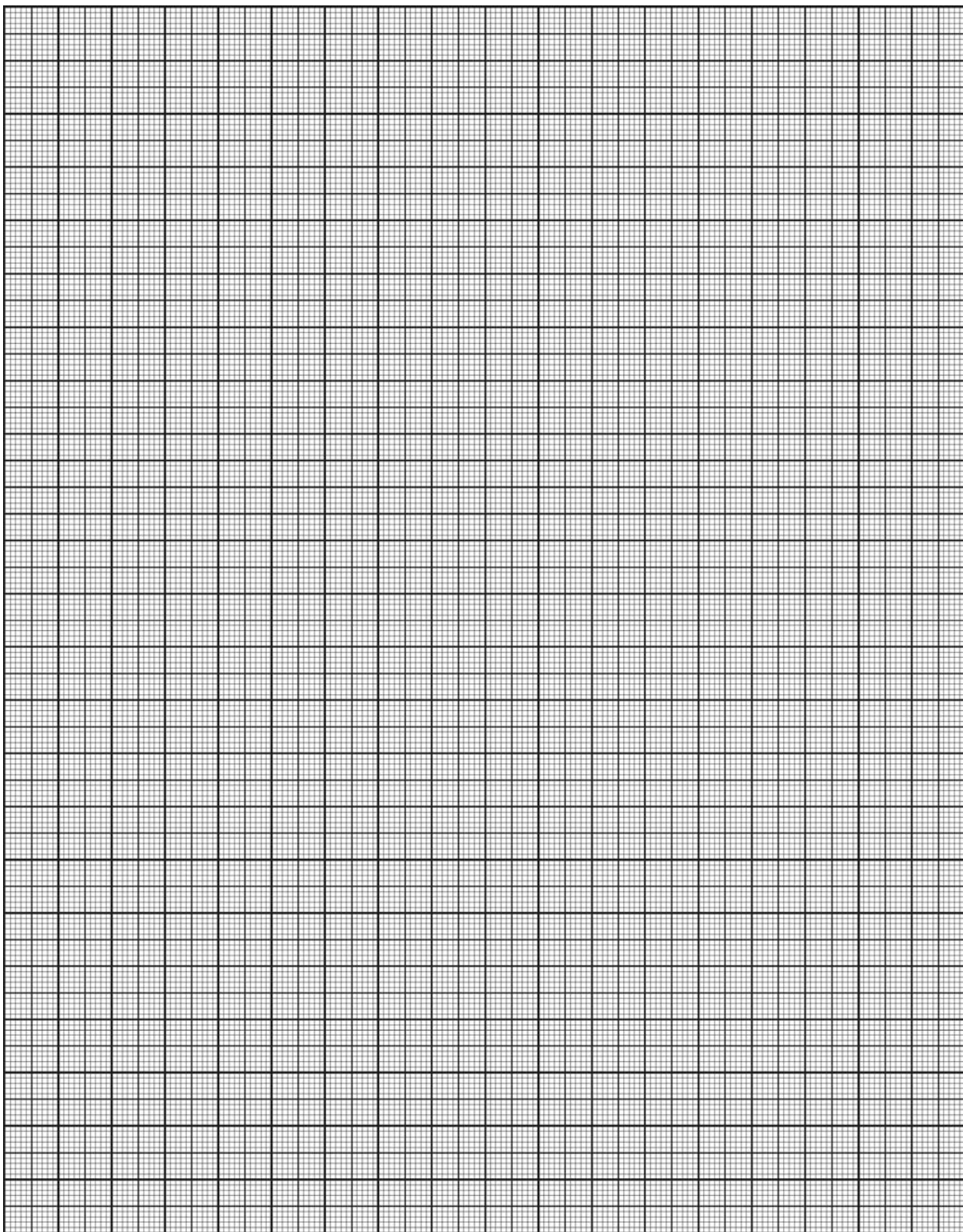




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