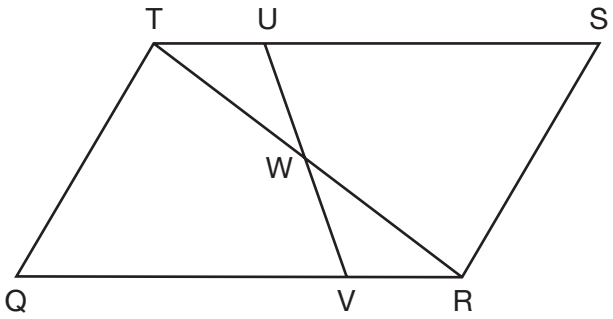
Use this space for computations.

3 In parallelogram $QRST$ shown below, diagonal $\overline{TR}$ is drawn, U and V are points on $\overline{TS}$ and $\overline{QR}$, respectively, and $\overline{UV}$ intersects $\overline{TR}$ at W.



If $m\angle S = 60°$, $m\angle SRT = 83°$, and $m\angle TWU = 35°$, what is $m\angle WVQ$?

(1) 37°
(2) 60°
(3) 72°
(4) 83°

4 A fish tank in the shape of a rectangular prism has dimensions of 14 inches, 16 inches, and 10 inches. The tank contains 1680 cubic inches of water. What percent of the fish tank is empty?

(1) 10
(2) 25
(3) 50
(4) 75

5 Which transformation would result in the perimeter of a triangle being different from the perimeter of its image?

(1) $(x,y) \rightarrow (y,x)$
(2) $(x,y) \rightarrow (x,-y)$
(3) $(x,y) \rightarrow (4x,4y)$
(4) $(x,y) \rightarrow (x + 2,y - 5)$

Use this space for computations.

9 In $\triangle ABC$, the complement of $\angle B$ is $\angle A$. Which statement is always true?

(1) $\tan \angle A = \tan \angle B$

(2) $\sin \angle A = \sin \angle B$

(3) $\cos \angle A = \tan \angle B$

(4) $\sin \angle A = \cos \angle B$

10 A line that passes through the points whose coordinates are (1,1) and (5,7) is dilated by a scale factor of 3 and centered at the origin. The image of the line

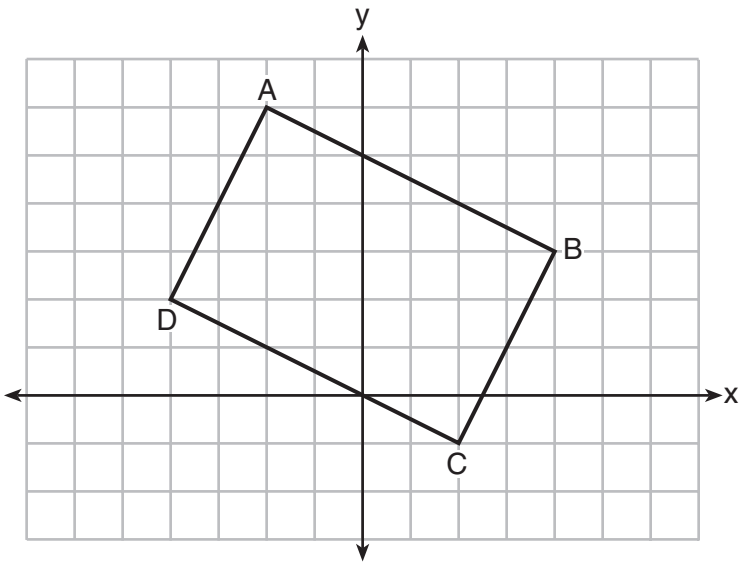
(1) is perpendicular to the original line

(2) is parallel to the original line

(3) passes through the origin

(4) is the original line

11 Quadrilateral *ABCD* is graphed on the set of axes below.



When *ABCD* is rotated 90° in a counterclockwise direction about the origin, its image is quadrilateral $A'B'C'D'$. Is distance preserved under this rotation, and which coordinates are correct for the given vertex?

(1) no and $C'(1,2)$

(2) no and $D'(2,4)$

(3) yes and $A'(6,2)$

(4) yes and $B'(-3,4)$

Use this space for computations.

15 The endpoints of one side of a regular pentagon are $(-1,4)$ and $(2,3)$. What is the perimeter of the pentagon?

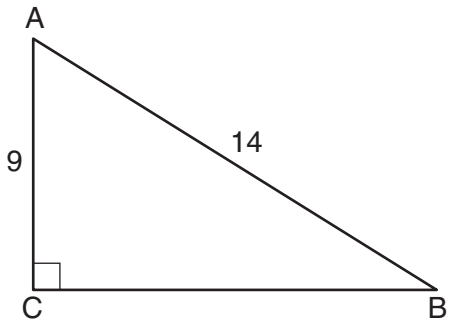
(1) $\sqrt{10}$

(2) $5\sqrt{10}$

(3) $5\sqrt{2}$

(4) $25\sqrt{2}$

16 In the diagram of right triangle ABC shown below, $AB = 14$ and $AC = 9$.



What is the measure of $\angle A$, to the *nearest degree*?

(1) 33

(2) 40

(3) 50

(4) 57

17 What are the coordinates of the center and length of the radius of the circle whose equation is $x^2 + 6x + y^2 - 4y = 23$?

(1) $(3,-2)$ and 36

(2) $(3,-2)$ and 6

(3) $(-3,2)$ and 36

(4) $(-3,2)$ and 6

18 The coordinates of the vertices of $\triangle RST$ are $R(-2,-3)$, $S(8,2)$, and $T(4,5)$. Which type of triangle is $\triangle RST$?

(1) right

(2) acute

(3) obtuse

(4) equiangular

1

Use this space for computations.

20 The ratio of similarity of $\triangle BOY$ to $\triangle GRL$ is 1:2. If $BO = x + 3$ and $GR = 3x - 1$, then the length of $\overline{GR}$ is

(1) 5

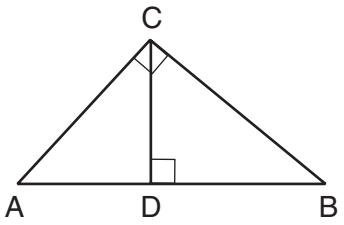
(2) 7

(3) 10

(4) 20

Use this space for computations.

22 In the diagram below, $\overline{CD}$ is the altitude drawn to the hypotenuse $\overline{AB}$ of right triangle ABC.



Which lengths would *not* produce an altitude that measures $6\sqrt{2}$?

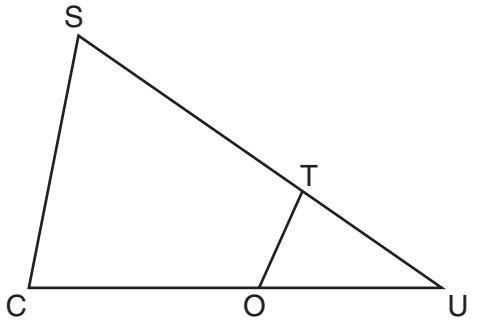
(1) $AD = 2$ and $DB = 36$

(2) $AD = 3$ and $AB = 24$

(3) $AD = 6$ and $DB = 12$

(4) $AD = 8$ and $AB = 17$

24 In $\triangle SCU$ shown below, points T and O are on $\overline{SU}$ and $\overline{CU}$, respectively. Segment OT is drawn so that $\angle C \cong \angle OTU$.



If $TU = 4$, $OU = 5$, and $OC = 7$, what is the length of $\overline{ST}$?

(1) 5.6

(2) 8.75

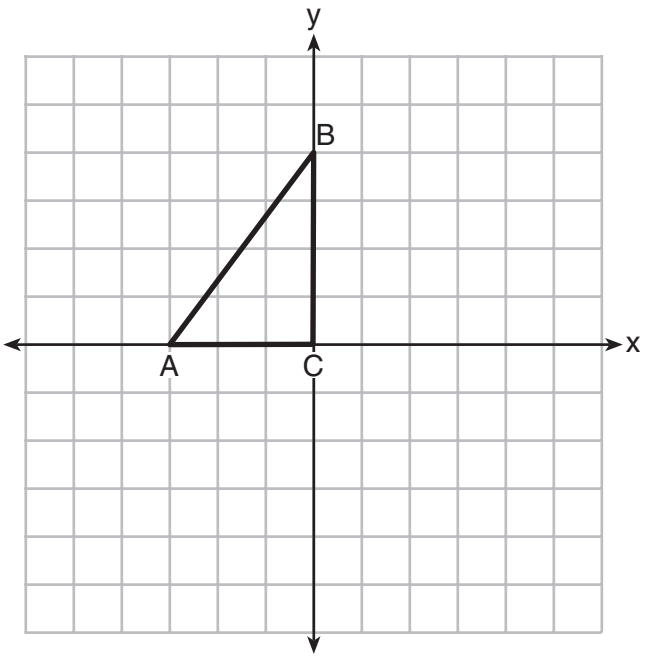
(3) 11

(4) 15

Part II

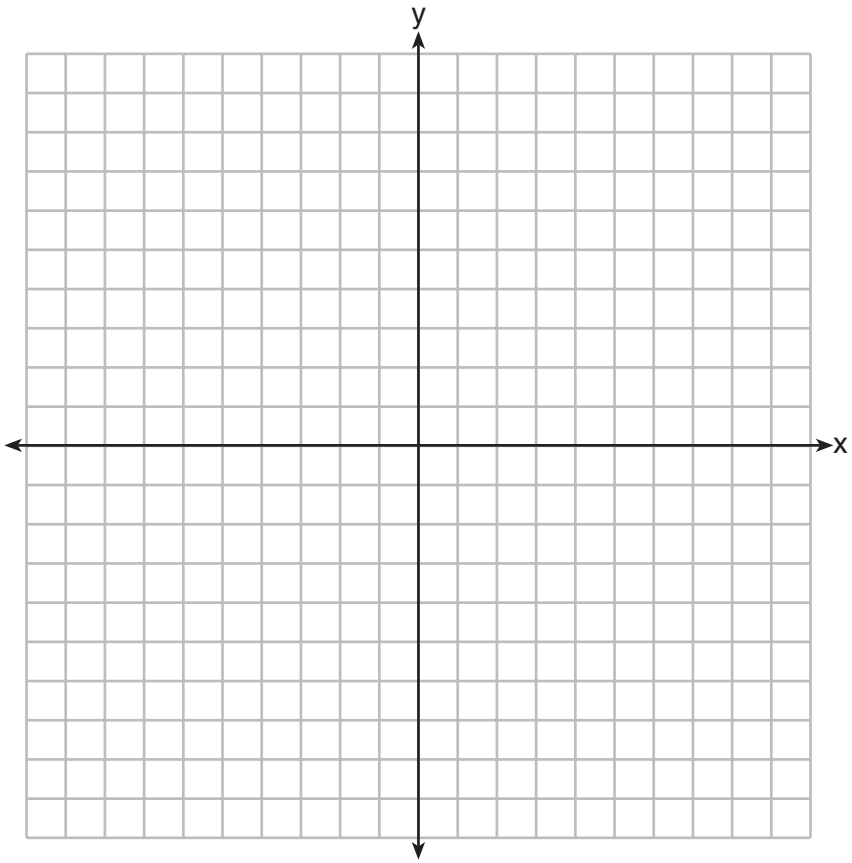
Answer all 7 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [14]

25 Triangle ABC is graphed on the set of axes below. Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a reflection over the line $x = 1$.

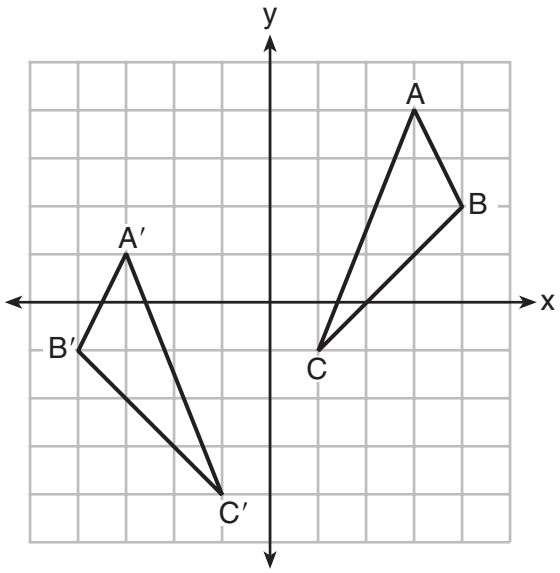


27 Directed line segment PT has endpoints whose coordinates are $P(-2,1)$ and $T(4,7)$. Determine the coordinates of point J that divides the segment in the ratio 2 to 1.

[The use of the set of axes below is optional.]

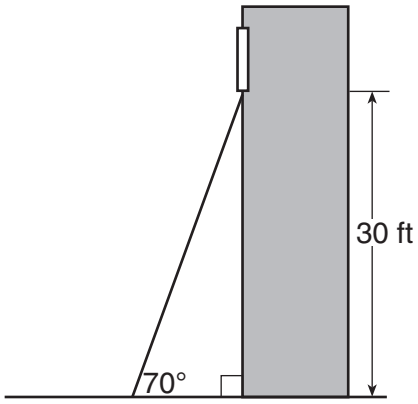


28 As graphed on the set of axes below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a sequence of transformations.



Is $\triangle A'B'C'$ congruent to $\triangle ABC$? Use the properties of rigid motion to explain your answer.

29 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a 70° angle with the ground. To the *nearest foot*, determine and state the length of the ladder.



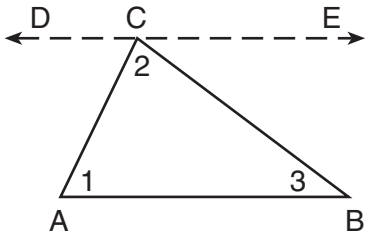
31 Line ℓ is mapped onto line m by a dilation centered at the origin with a scale factor of 2. The equation of line ℓ is $3x - y = 4$. Determine and state an equation for line m.

Part III

Answer all 3 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.



Given: $\triangle ABC$

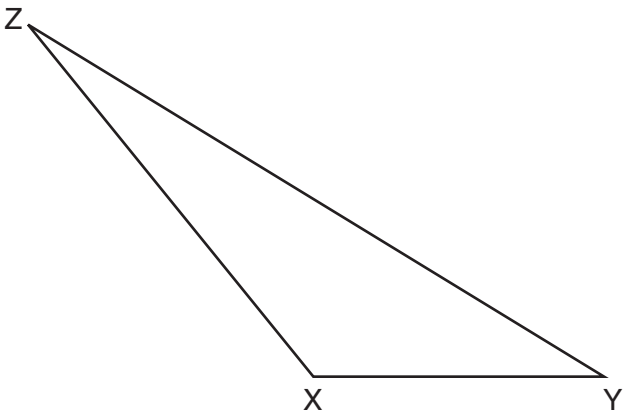
Prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180°$

Fill in the missing reasons below.

Statements	Reasons
(1) $\triangle ABC$	(1) Given
(2) Through point C, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) _____
(3) $m\angle 1 = m\angle ACD$, $m\angle 3 = m\angle BCE$	(3) _____
(4) $m\angle ACD + m\angle 2 + m\angle BCE = 180°$	(4) _____
(5) $m\angle 1 + m\angle 2 + m\angle 3 = 180°$	(5) _____

34 Triangle XYZ is shown below. Using a compass and straightedge, on the line below, construct and label $\triangle ABC$, such that $\triangle ABC \cong \triangle XYZ$. [Leave all construction marks.]

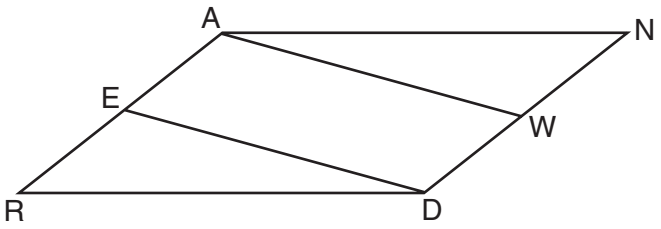
Based on your construction, state the theorem that justifies why $\triangle ABC$ is congruent to $\triangle XYZ$.



Part IV

Answer the 2 questions in this part. Each correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

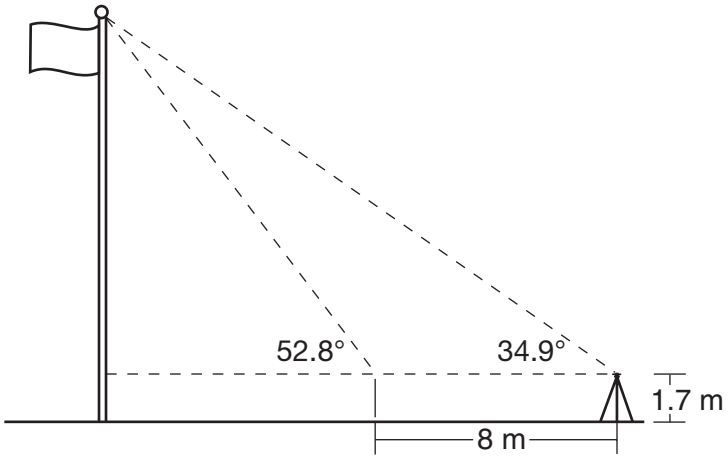
35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively



Prove that $\triangle ANW \cong \triangle DRE$.

Prove that quadrilateral *AWDE* is a parallelogram.

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.



Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

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High School Math Reference Sheet

1 inch = 2.54 centimeters
1 meter = 39.37 inches
1 mile = 5280 feet
1 mile = 1760 yards
1 mile = 1.609 kilometers

1 kilometer = 0.62 mile
1 pound = 16 ounces
1 pound = 0.454 kilogram
1 kilogram = 2.2 pounds
1 ton = 2000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 3.785 liters
1 liter = 0.264 gallon
1 liter = 1000 cubic centimeters

Triangle	$A = \frac{1}{2}bh$
Parallelogram	$A = bh$
Circle	$A = \pi r^2$
Circle	$C = \pi d$ or $C = 2\pi r$
General Prisms	$V = Bh$
Cylinder	$V = \pi r^2 h$
Sphere	$V = \frac{4}{3}\pi r^3$
Cone	$V = \frac{1}{3}\pi r^2 h$
Pyramid	$V = \frac{1}{3}Bh$

Pythagorean Theorem	$a^2 + b^2 = c^2$
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Geometric Sequence	$a_n = a_1 r^{n-1}$
Geometric Series	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Radians	1 radian $= \frac{180}{\pi}$ degrees
Degrees	1 degree $= \frac{\pi}{180}$ radians
Exponential Growth/Decay	$A = A_0 e^{k(t - t_0)} + B_0$

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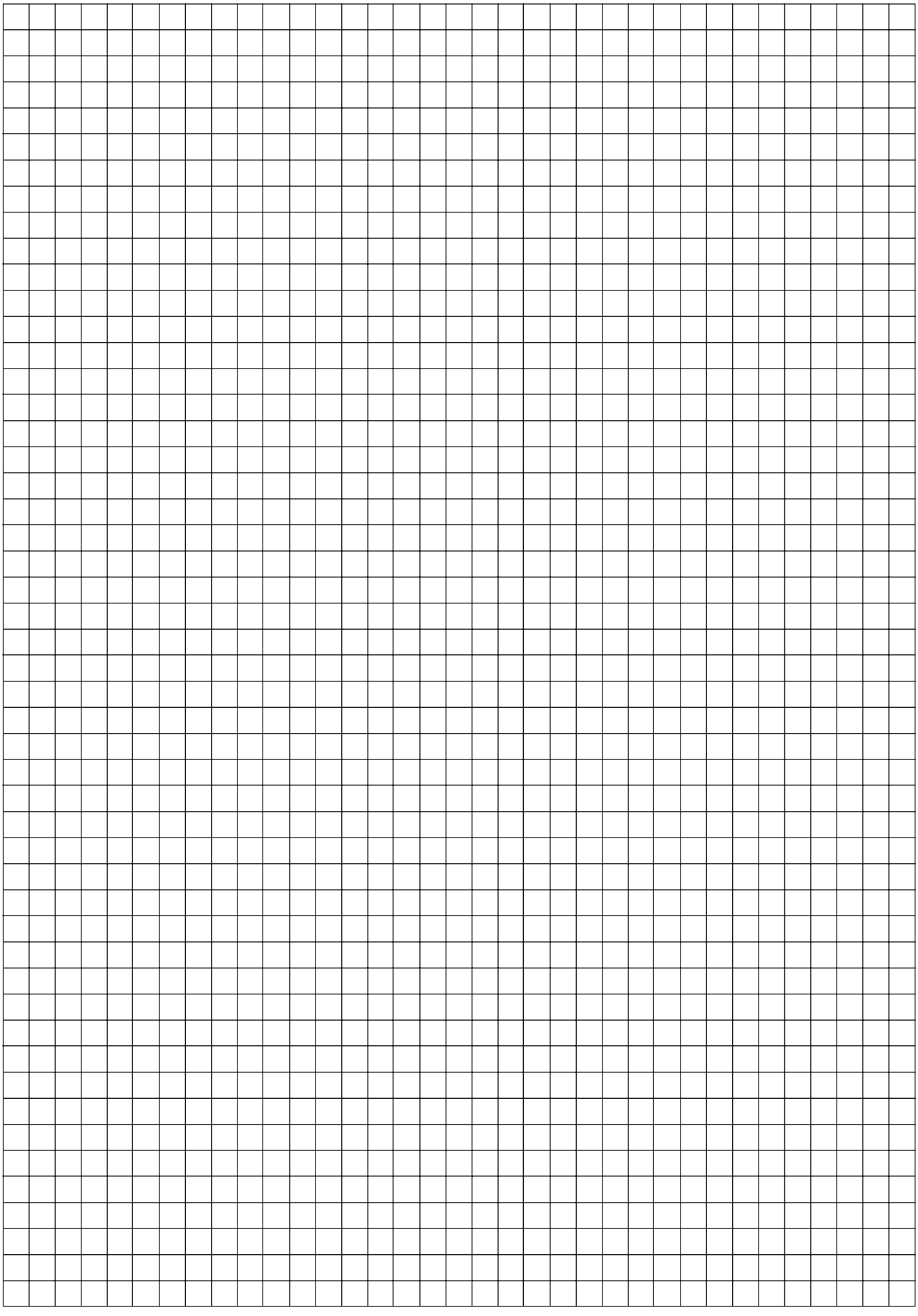

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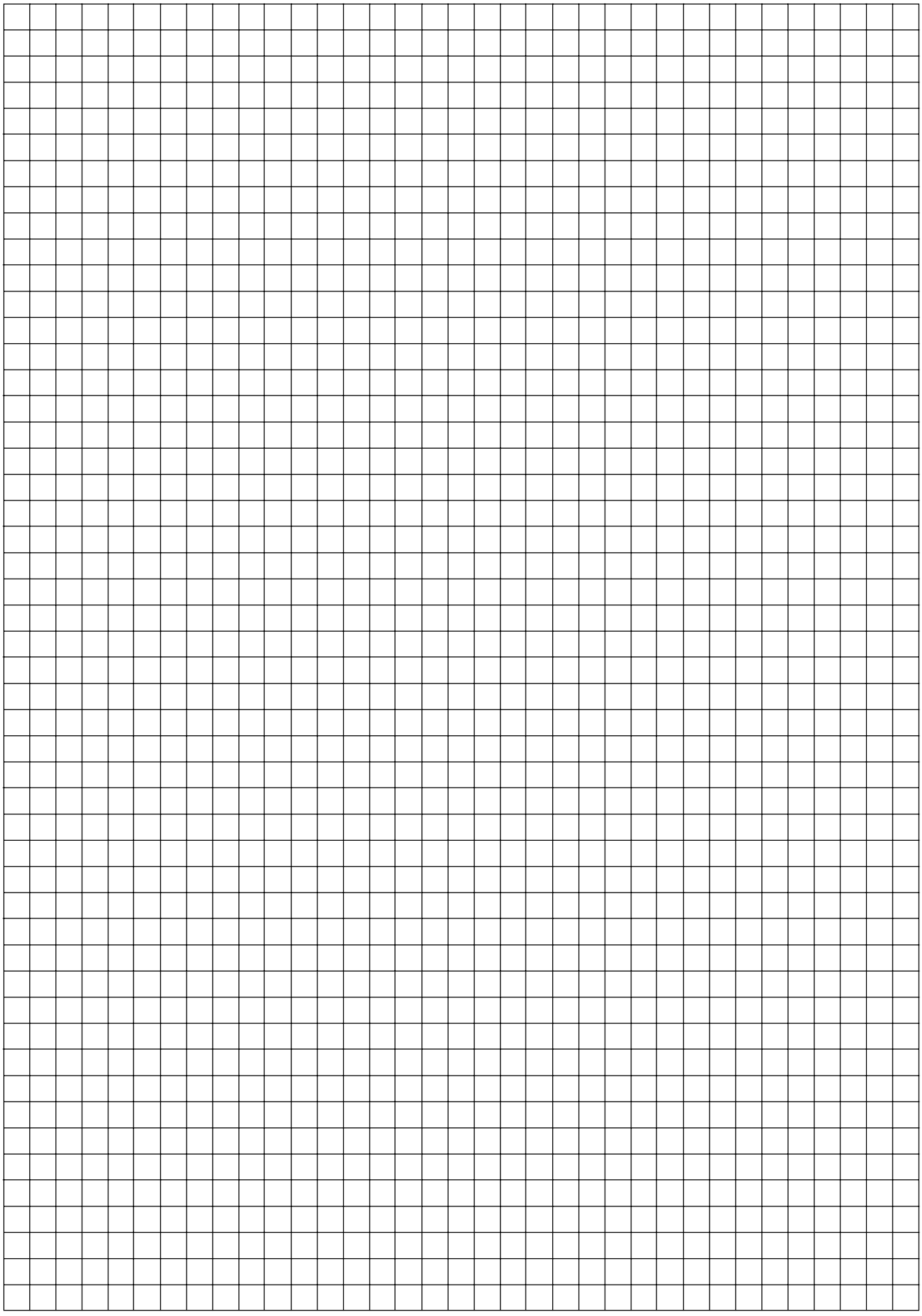

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