Large-Type Edition

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

GEOMETRY

Wednesday, January 22, 2025 — 9:15 a.m. to 12:15 p.m., only

Student Name: _____

School Name: _____

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Print your name and the name of your school on the lines above.

A separate answer sheet for **Part I** has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 35 questions. You must answer all questions in this examination. Record your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in **Parts II, III,** and **IV** directly in this booklet. All work should be written in pen, except graphs and drawings, which should be done in pencil. 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.

The formulas that you may need to answer some questions in this examination are found at the end of the examination. You may remove this sheet from this booklet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will *not* be scored.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice …
A graphing calculator, a straightedge (ruler), and a compass must be available for you to use while taking this examination.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers on your separate answer sheet. [48]

Use this space for computations.

1 On the set of axes below, $\triangle AB'C'$ is the image of $\triangle ABC$.

What is the scale factor and center of dilation that maps $\triangle ABC$ onto $\triangle AB'C'$?

(1) $\frac{1}{2}$ and the origin

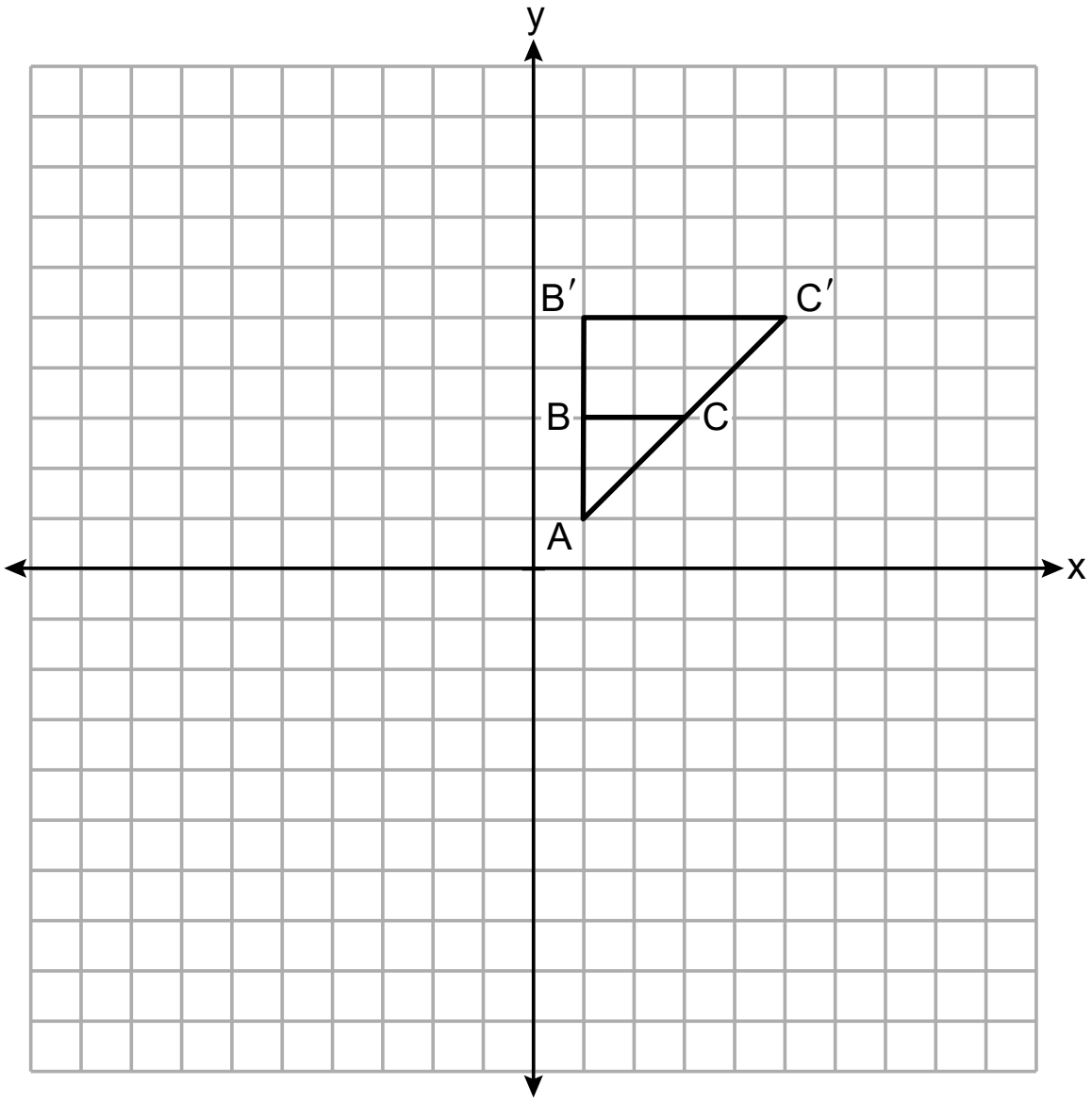
(2) 2 and the origin

(3) $\frac{1}{2}$ and vertex A

(4) 2 and vertex A

The graph for question 1 is on the page below.

Use this space for computations.



Use this space for computations.

2 Line segment PAQ has endpoints whose coordinates are $P(-2,6)$ and $Q(3,-4)$. What are the coordinates of point A, such that $PA:AQ = 2:3$?

(1) $(1,0)$

(2) $(2,-2)$

(3) $(-1,4)$

(4) $(0,2)$

3 On the set of axes below, congruent parallelograms $ABCD$ and $RSTU$ are graphed.

Which sequence of transformations maps $ABCD$ onto $RSTU$?

(1) a reflection over the x-axis followed by a translation ten units to the left and one unit up

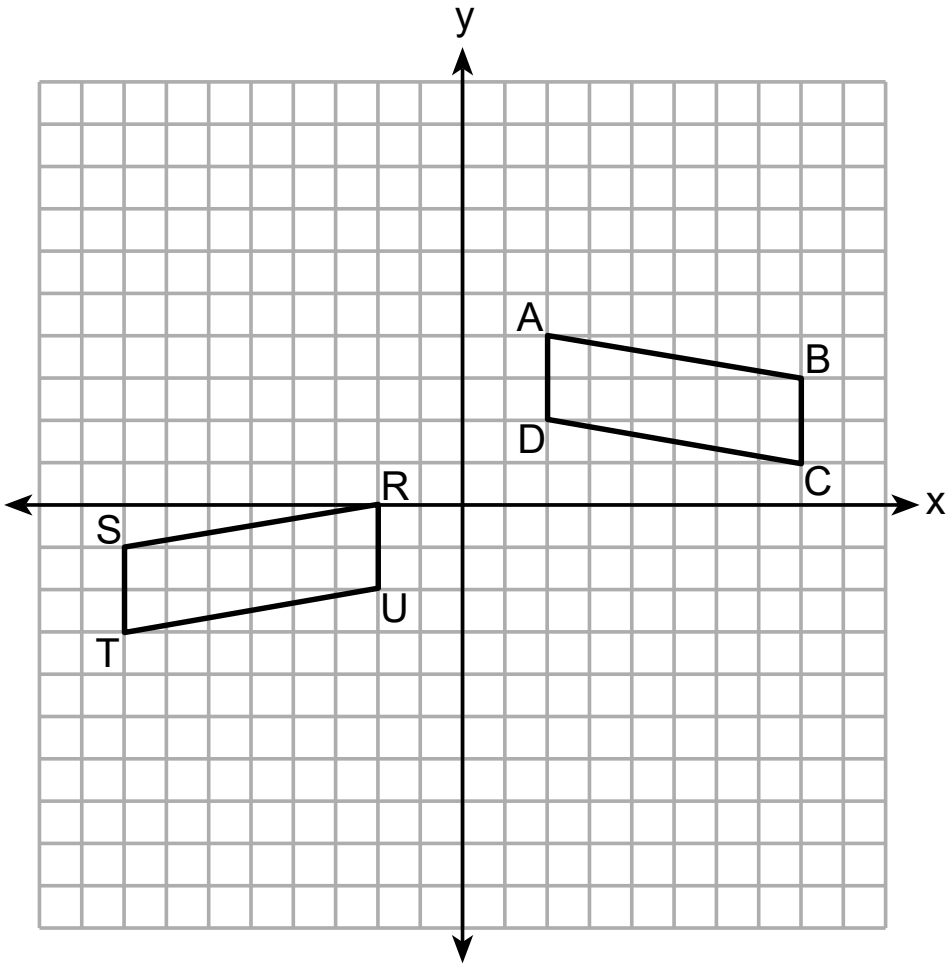
(2) a translation four units down followed by a reflection over the y-axis

(3) a reflection over the y-axis followed by a translation of two units down

(4) a translation ten units to the left followed by a reflection over the x-axis

The graph for question 3 is on the page below.

Use this space for computations.



Use this space for computations.

4 Triangle ABC has a right angle at C. If $AC = 7.7$ and $m\angle B = 24°$, what is AB, to the *nearest tenth*?

(1) 18.9

(2) 17.3

(3) 8.4

(4) 3.1

5 Given $\triangle PQR$ and $\triangle LMN$ with $\overline{PQ} \cong \overline{LM}$, which additional statement is sufficient to always prove $\triangle PQR \cong \triangle LMN$?

(1) $\overline{QR} \cong \overline{MN}$ and $\angle R \cong \angle N$

(2) $\overline{QR} \cong \overline{MN}$ and $\angle Q \cong \angle M$

(3) $\overline{QR} \cong \overline{MN}$ and $\angle P \cong \angle L$

(4) $\overline{QR} \cong \overline{MN}$ and $\angle P \cong \angle M$

6 The equation of a circle is $x^2 + 6y = 4x - y^2 + 12$. What are the coordinates of the center and the length of the radius?

(1) center $(2,-3)$ and radius 5

(2) center $(-2,3)$ and radius 5

(3) center $(2,-3)$ and radius 25

(4) center $(-2,3)$ and radius 25

Use this space for computations.

7 A square with a side length of 3 is continuously rotated about one of its sides. The resulting three-dimensional object is a

(1) cube with a volume of 9.

(2) cube with a volume of 27.

(3) cylinder with a volume of 27π.

(4) cylinder with a volume of 54π.

8 Line k is represented by the equation $4y + 3 = 7x$. Which equation represents a line that is perpendicular to line k and passes through the point $(-5,2)$?

(1) $y + 2 = \frac{4}{7}(x - 5)$

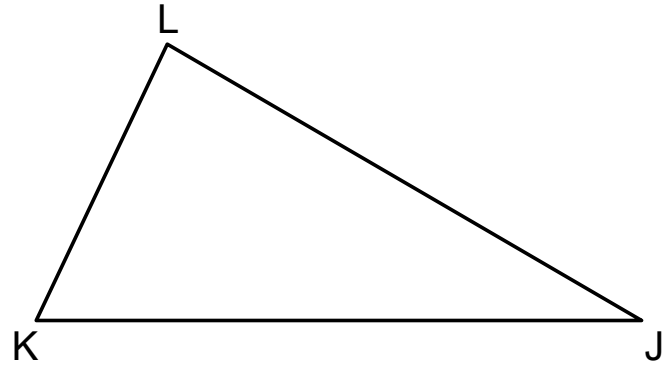
(2) $y - 2 = \frac{4}{7}(x + 5)$

(3) $y + 2 = -\frac{4}{7}(x - 5)$

(4) $y - 2 = -\frac{4}{7}(x + 5)$

Use this space for computations.

9 Scalene triangle JKL is drawn below.



If median $\overline{LM}$ is drawn to side $\overline{KJ}$, which statement is always true?

(1) $LM = KM$

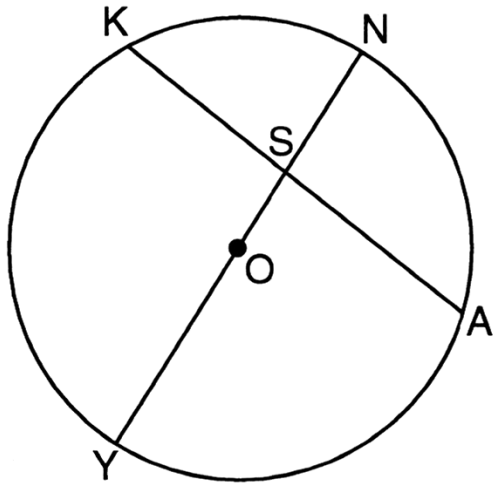
(2) $KM = \frac{1}{2}KJ$

(3) $\overline{LM} \perp \overline{KJ}$

(4) $\angle KLM \cong \angle JLM$

Use this space for computations.

10 In circle O, chord $\overline{KA}$ intersects diameter $\overline{YN}$ at S.



If $m\overset{\frown}{YK} = 120°$ and $m\overset{\frown}{YA} = 105°$, what is $m\angle ASN$?

(1) 22.5°

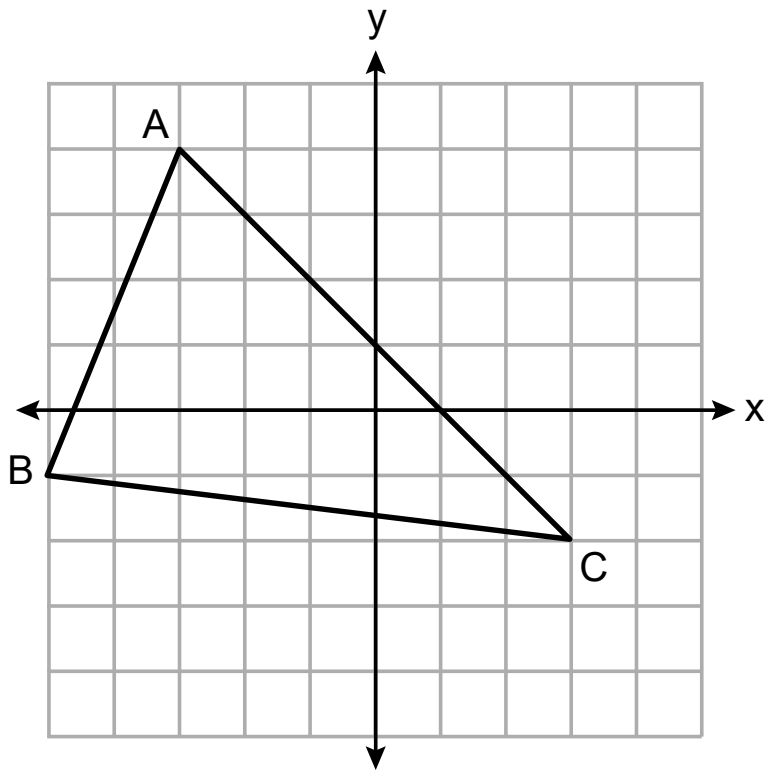
(2) 75°

(3) 97.5°

(4) 120°

Use this space for computations.

11 Triangle ABC is graphed on the set of axes below. The vertices of $\triangle ABC$ have coordinates $A(-3,4)$, $B(-5,-1)$, and $C(3,-2)$.



What is the area of $\triangle ABC$?

(1) 16

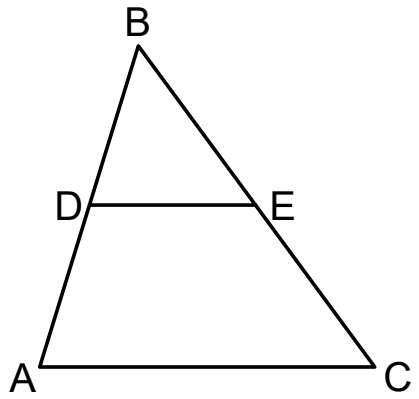
(2) 20

(3) 21

(4) 24

12 In $\triangle ABC$ below, $\overline{DE}$ is a midsegment, and $\overline{BD} \cong \overline{DE}$.

Use this space for computations.



Which statement is always true?

(1) $\triangle ABC$ is isosceles

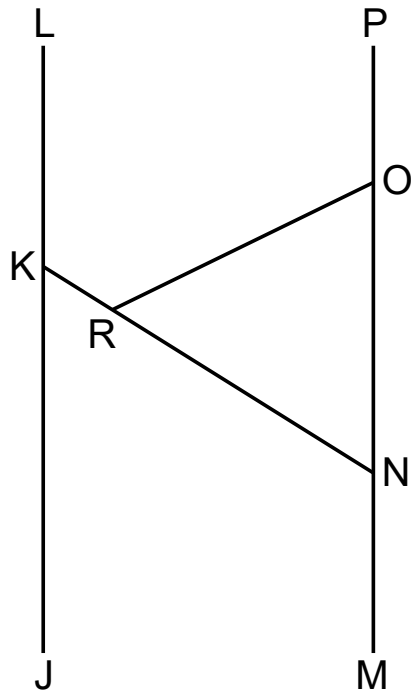
(2) $\triangle ABC$ is scalene

(3) $\overline{BD} \cong \overline{BE}$

(4) $\overline{DA} \cong \overline{EC}$

Use this space for computations.

13 As shown in the diagram below, $\overline{JKL} \parallel \overline{MNOP}$, $\overline{KRN}$, and $\overline{OR} \cong \overline{ON}$.



If $m\angle POR = 116°$, what is $m\angle LKN$?

(1) 58°

(2) 116°

(3) 122°

(4) 128°

Use this space for computations.

14 The ratio of similarity of square $ABCD$ to square $WXYZ$ is 2:5. If $AB = x + 3$ and $WX = 3x + 5$, then the perimeter of $ABCD$ is

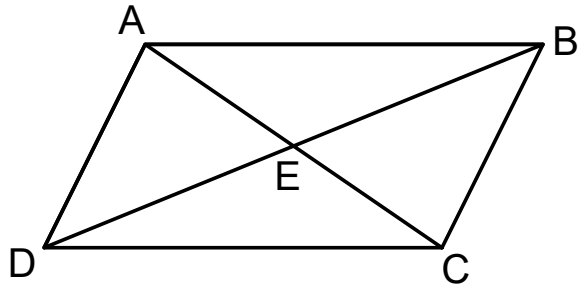
(1) 8

(2) 20

(3) 32

(4) 80

15 In parallelogram $ABCD$ below, diagonals $\overline{AC}$ and $\overline{BD}$ intersect at E.



Which transformation would map $\triangle ABC$ onto $\triangle CDA$?

(1) a reflection over $\overline{AC}$

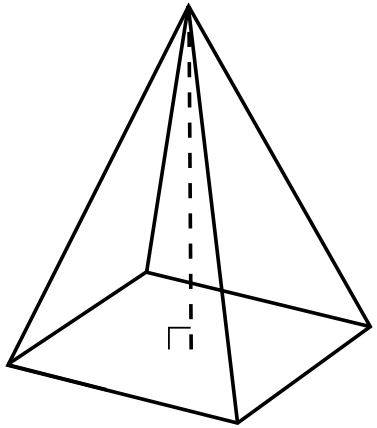
(2) a reflection over $\overline{DB}$

(3) a clockwise rotation of 90° about point E

(4) a clockwise rotation of 180° about point E

Use this space for computations.

16 The square pyramid drawn below has a volume of 175.



If the height of the pyramid is 21, what is the perimeter of the base?

(1) 5

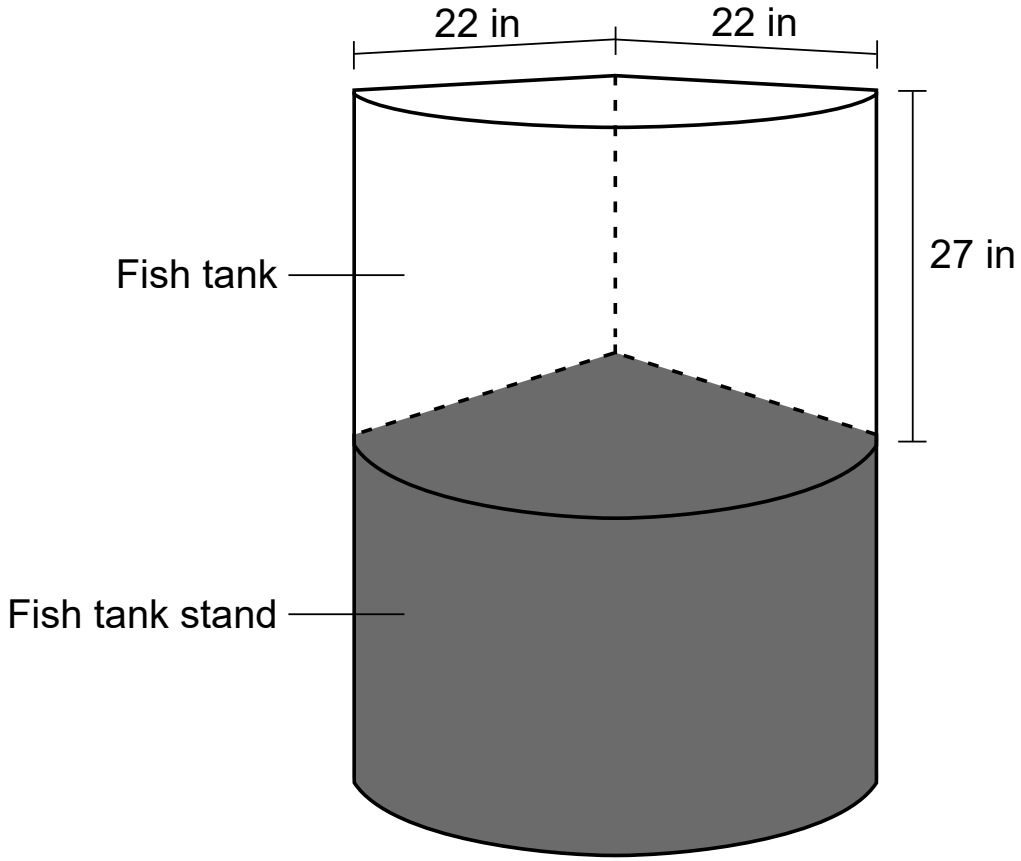
(2) 10

(3) 20

(4) 25

17 A glass fish tank is designed to be placed on a stand in the corner of a room with perpendicular walls. The tank can be modeled using part of a cylinder, as shown below. The inner length of the fish tank along the wall is 22 inches, and the height of the tank is 27 inches.

Use this space for computations.



How much water, to the *nearest gallon*, does the fish tank hold? [1 gal = 231 in^3]

(1) 44

(2) 59

(3) 89

(4) 178

Use this space for computations.

18 Line m, whose equation is $y = -2x + 8$, is dilated by a scale factor of $\frac{1}{2}$ centered at the origin. Which equation represents the image of line m?

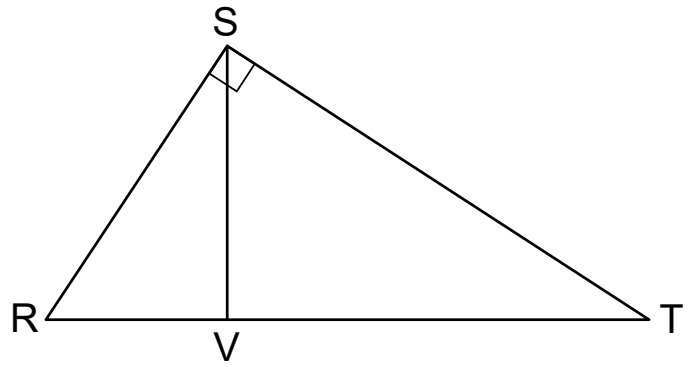
(1) $y = -x + 4$

(2) $y = -2x + 4$

(3) $y = -x + 8$

(4) $y = -2x + 8$

19 In right triangle RST below, altitude $\overline{SV}$ is drawn to hypotenuse $\overline{RT}$.



Which statement is always true?

(1) $\frac{RT}{ST} = \frac{ST}{VT}$

(2) $\frac{VR}{VT} = \frac{VT}{VS}$

(3) $\frac{RV}{SV} = \frac{SV}{RT}$

(4) $\frac{TR}{VR} = \frac{VR}{SR}$

Use this space for computations.

20 What is the measure, in radians, of a central angle that intercepts an arc length of 12π cm in a circle with a diameter of 36 cm?

(1) $\frac{\pi}{6}$

(2) $\frac{\pi}{3}$

(3) $\frac{2\pi}{3}$

(4) $\frac{3\pi}{2}$

21 A regular nonagon has a center point, P. What degree of rotation about point P will carry the nonagon onto itself?

(1) $60°$

(2) $90°$

(3) $180°$

(4) $200°$

Use this space for computations.

22 If two sides of a triangle have lengths of 2 and 7, the length of the third side could be

(1) 9

(2) 8

(3) 5

(4) 4

23 The car tire shown in the photograph below has a diameter of $2\frac{1}{4}$ feet.

Approximately how many rotations will the tire make in one mile?

(1) 373

(2) 747

(3) 1328

(4) 2347

Use this space for computations.

24 In quadrilateral $TOWN$, $\overline{OW} \cong \overline{TN}$ and $\overline{OT} \cong \overline{WN}$. Which additional information is sufficient to prove quadrilateral $TOWN$ is a rhombus?

(1) $\overline{ON} \perp \overline{TW}$

(2) $\overline{TO} \perp \overline{OW}$

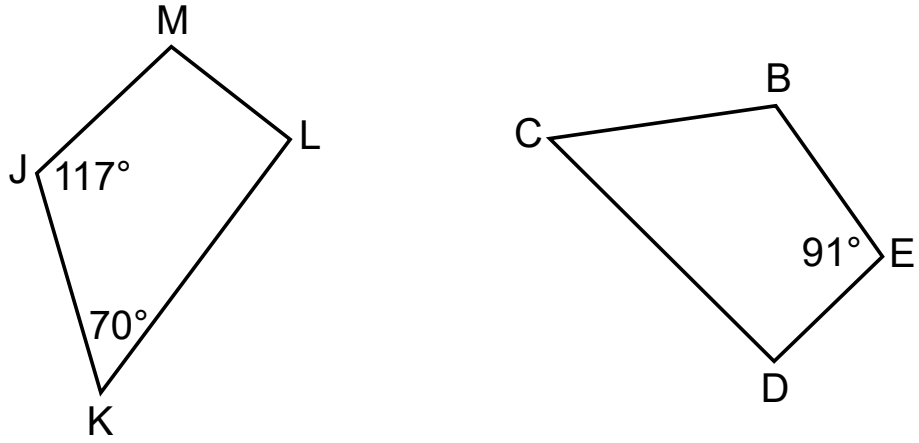
(3) $\overline{OW} \parallel \overline{TN}$

(4) $\overline{ON}$ and $\overline{TW}$ bisect each other.

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 In the diagram below, quadrilateral *BCDE* maps onto quadrilateral *JKLM* using a sequence of rigid motions.



Question 25 is continued on the next page.

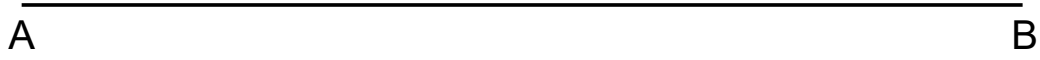
Question 25 continued

Determine and state the degree measure of angle D.

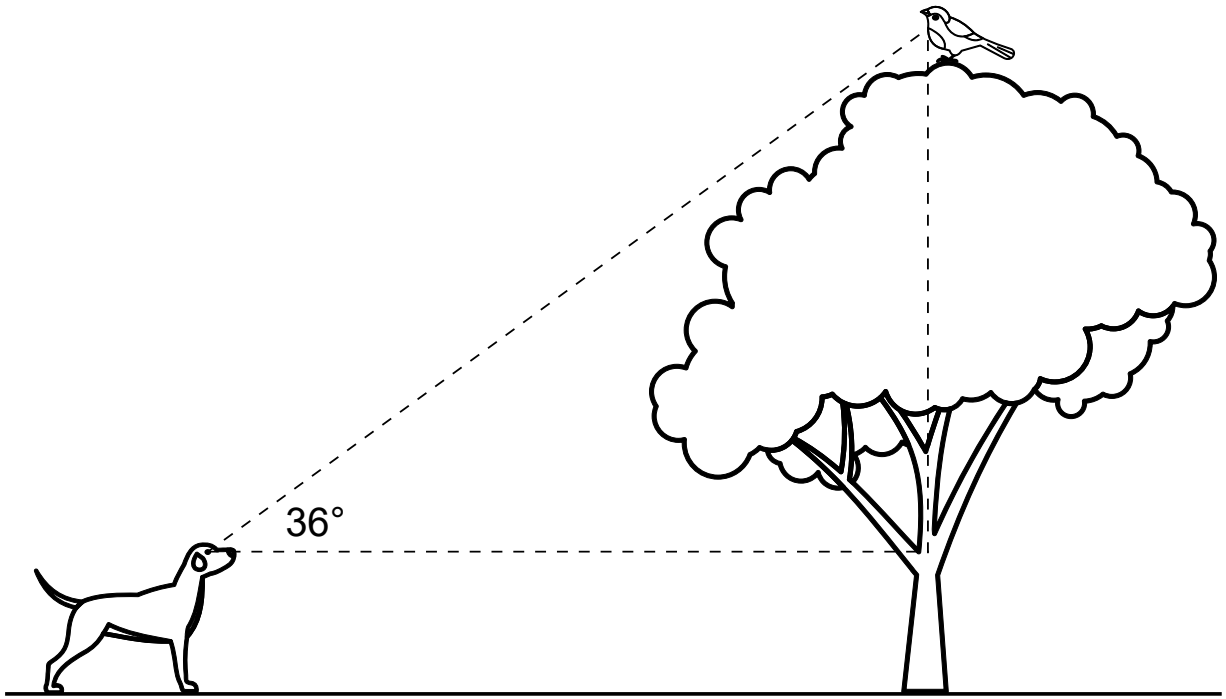
26 Given $\overline{AB}$ below, use a compass and a straightedge to construct a segment that is $\frac{1}{4}AB$.
[Leave all construction marks.]

Question 26 is continued on the next page.

Question 26 continued



27 A dog sees a bird in a tree. The angle of elevation from the dog's eyes to the bird is 36°, as modeled below.



The dog is 18.5 feet away from the base of the tree, and his eyes are 2.5 feet above the ground.

Question 27 is continued on the next page.

Question 27 continued

Determine and state how high the bird is above the ground, to the *nearest foot*.

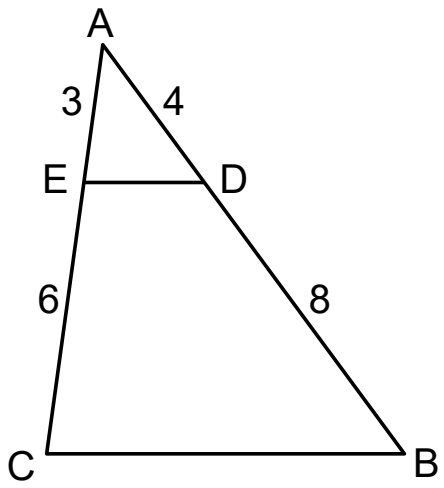
28 Pure silver has a density of 10.5 g/cm^3. Samantha has a pure silver charm on her necklace in the shape of a sphere. The radius of the charm is 0.5 cm.

Determine and state the mass of the charm, to the *nearest tenth of a gram*.

Work space for question 28 is continued on the next page.

Question 28 continued

29 In $\triangle ABC$ below, $\overline{DE}$ is drawn such that $AD = 4$, $DB = 8$, $AE = 3$, and $EC = 6$.

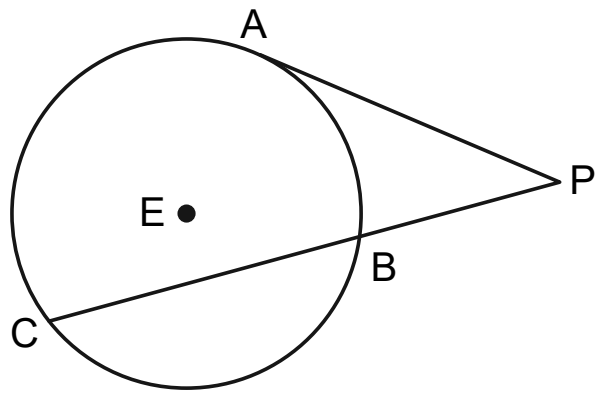


Explain why $\triangle ADE \sim \triangle ABC$.

Work space for question 29 is continued on the next page.

Question 29 continued

30 In circle E below, tangent $\overline{PA}$ and secant $\overline{PBC}$ are drawn.



If $PB = 9$ and $BC = 16$, determine and state the length of $\overline{PA}$.

Work space for question 30 is continued on the next page.

Question 30 continued

31 In a right triangle, $\sin(4x + 3)° = \cos(2x - 9)°$. Determine and state the value of x.

Work space for question 31 is continued on the next page.

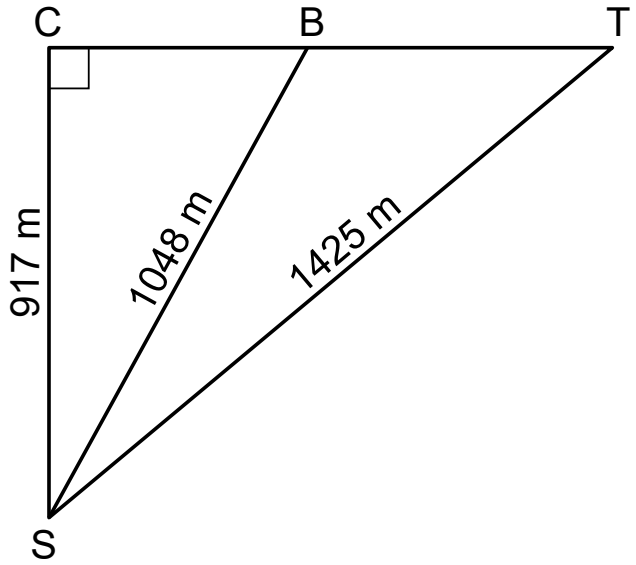
Question 31 continued

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 Modeled by right triangles below, a surveyor (S) is taking land measurements using a cabin (C), a boulder (B), and a tree (T) as fixed points of reference. The cabin, boulder, and tree are collinear.

The surveyor is 917 meters from the cabin, 1048 meters from the boulder, and 1425 meters from the tree.



Question 32 is continued on the next page.

Question 32 continued

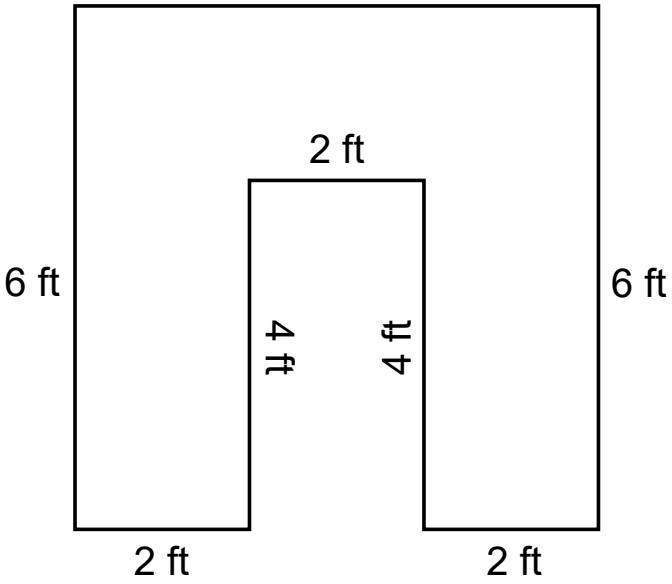
Determine and state, to the *nearest degree*, the measure of $\angle BST$.

33 A garden bed, pictured below, is a square prism with a rectangular prism taken out. The inside length of the square prism is 6 feet. The rectangular prism taken out has a width of 2 feet and a length of 4 feet.

The diagram below shows the top view of the garden bed with its inside measurements.

Garden Bed

Top View of Garden Bed



The garden bed is filled with topsoil to a uniform height of 1.25 feet.

Question 33 is continued on the next page.

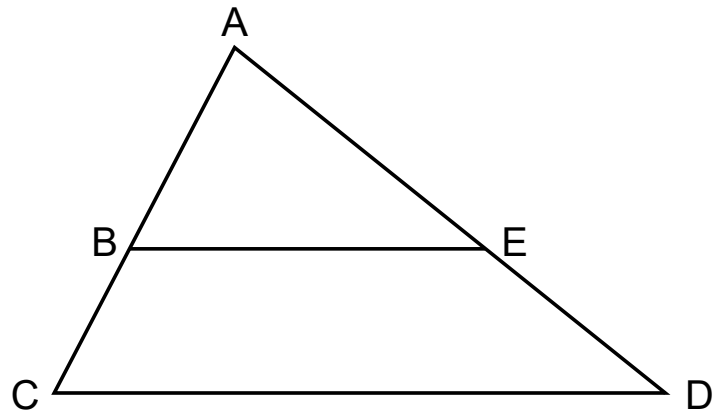
Question 33 continued

Determine and state the volume of the topsoil, in cubic feet.

Each bag of topsoil sells for $3.68 and contains 2 cubic feet of topsoil.

Determine and state the total cost of the bags of topsoil that must be purchased to fill the garden.

34 Given: $\triangle ACD$ with $\overline{ABC}$, $\overline{AED}$, and $\overline{BE} \parallel \overline{CD}$



Prove: $AB \cdot AD = AE \cdot AC$

Work space for question 34 is continued on the next page.

Question 34 continued

Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. 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. [6]

35 Triangle PET has vertices with coordinates $P(-6,4)$, $E(6,8)$, and $T(-4,-2)$.

Prove $\triangle PET$ is a right triangle.

[The use of the set of axes on page 45 is optional.]

Question 35 is continued on the next page.

Question 35 continued

State the coordinates of N, the image of P, after a 180° rotation centered at (1,3).

Question 35 is continued on the next page.

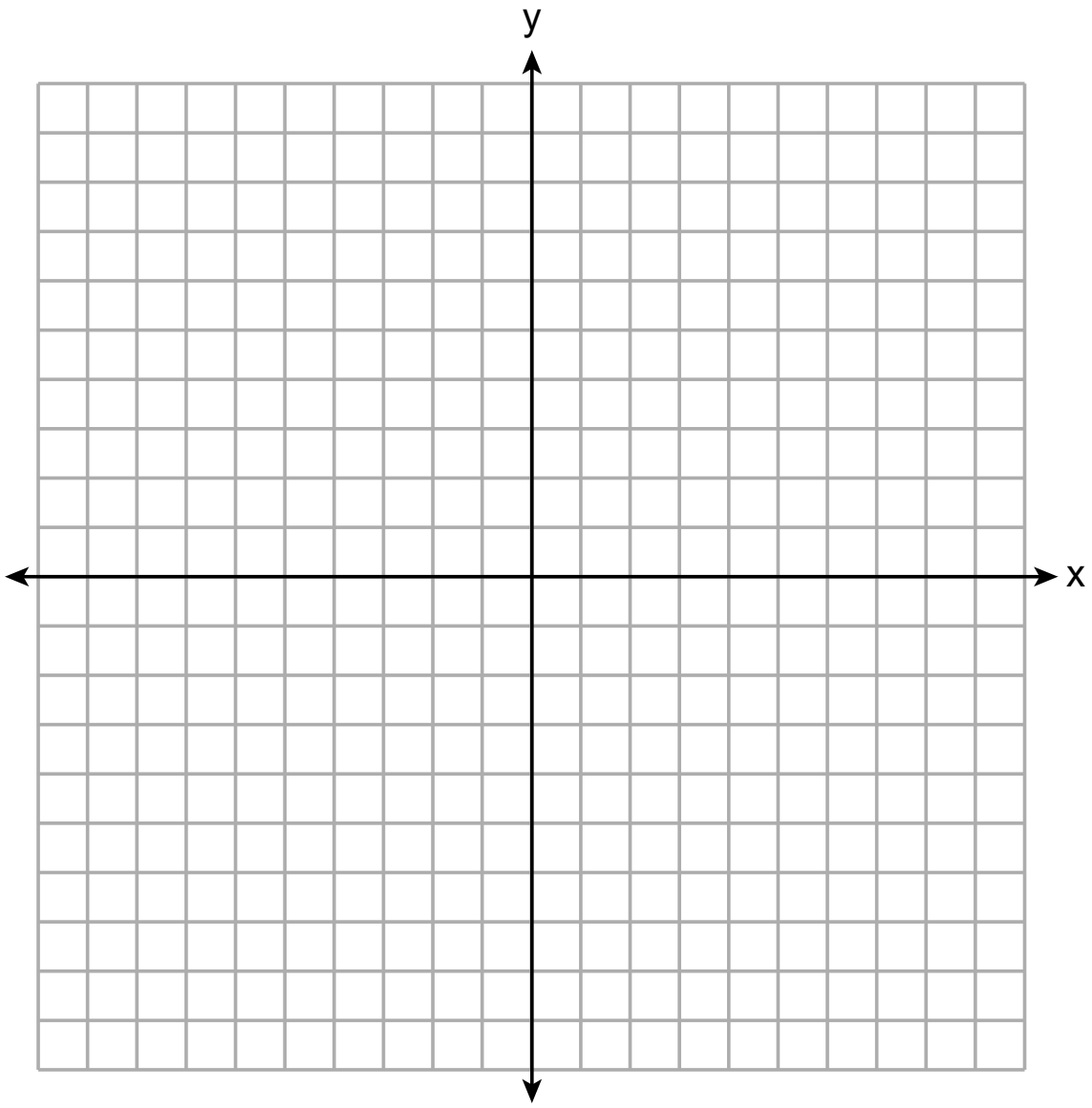
Question 35 continued

Prove *PENT* is a rectangle.

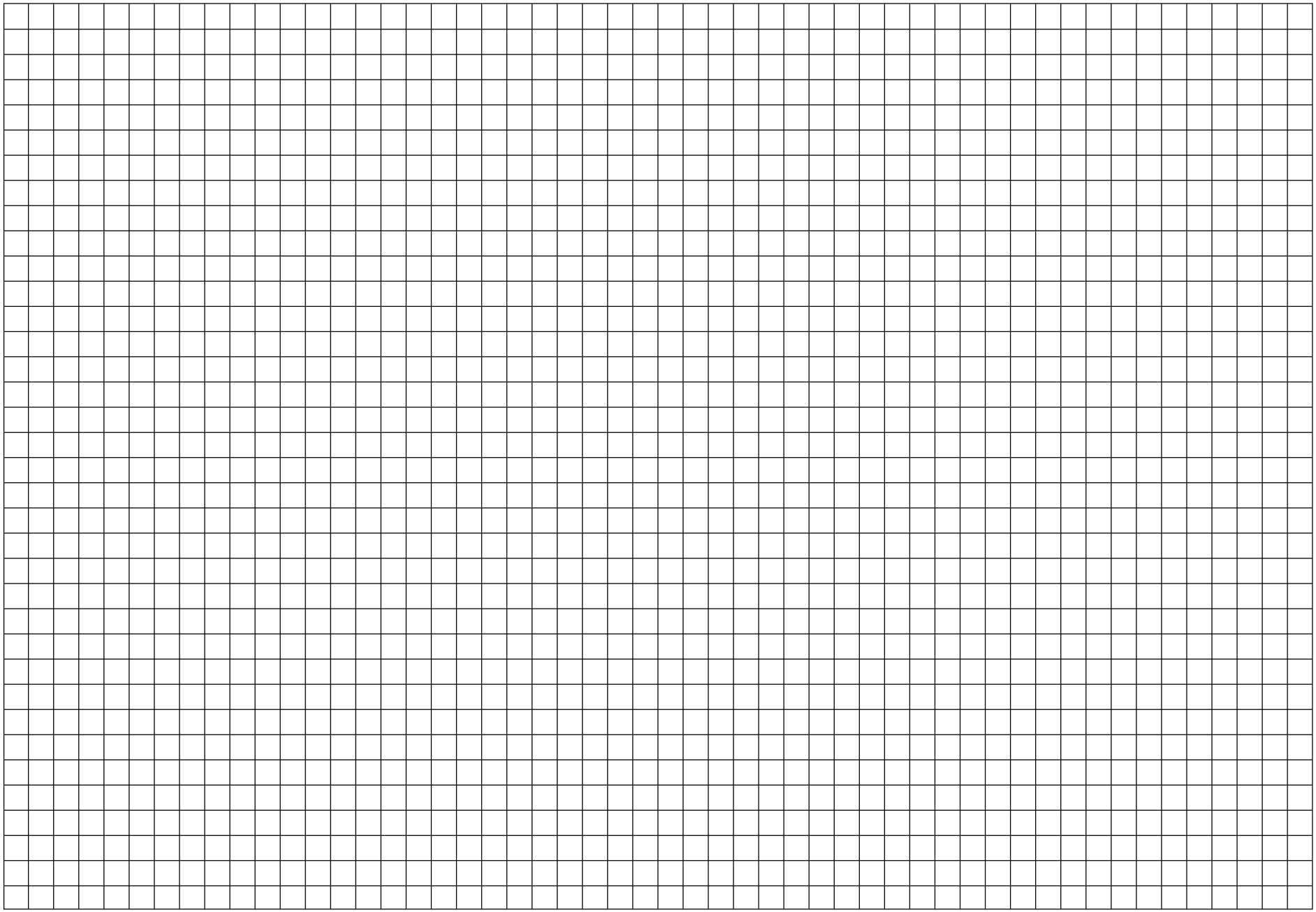
[The use of the set of axes on the next page is optional.]

The set of axes for question 35 is on the next page.

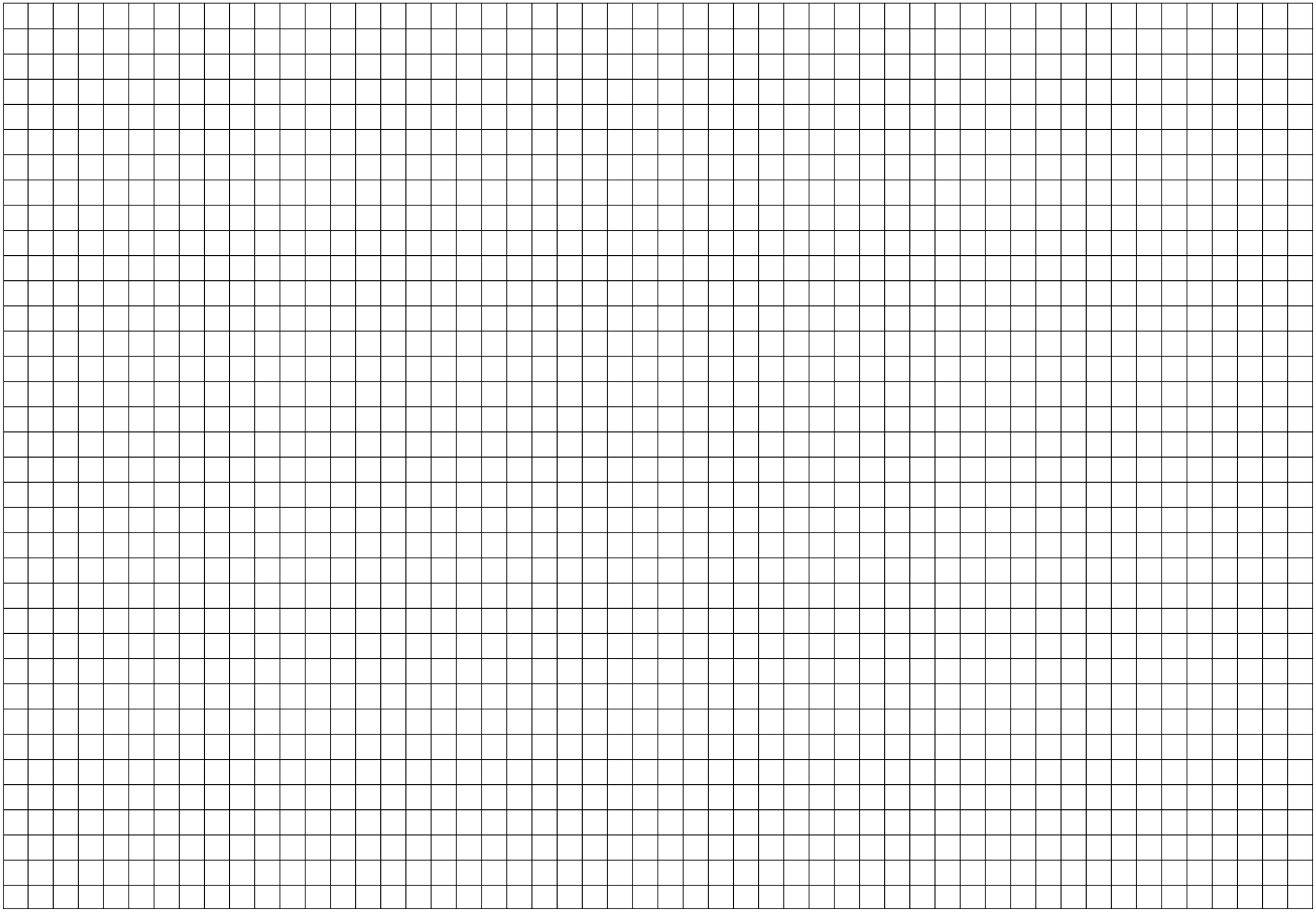
Question 35 continued



Scrap Graph Paper — this sheet will *not* be scored.



Scrap Graph Paper — this sheet will *not* be scored.



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	$V = Bh$

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	$S_n = \frac{a_1 - a_1 r^n}{1 - \mathrm{r}}$ where $r \neq 1$

The Reference Sheet is continued on the next page.

Cylinder	$V = \pi r^2 h$
Sphere	$V = \frac{4}{3}\pi r^3$
Cone	$V = \frac{1}{3}\pi r^2 h$
Pyramid	$V = \frac{1}{3}Bh$

Radians	1 radian $= \frac{180}{\pi}$ degrees
Degrees	1 degree $= \frac{\pi}{180}$ radians
Exponential Growth/Decay	$A = A_0 e^{k(t - t_0)} + B_0$