Large-Type Edition

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

GEOMETRY

Wednesday, January 23, 2019 — 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 for 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 START THIS EXAMINATION 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 After a dilation with center (0,0), the image of $\overline{DB}$ is $\overline{D'B'}$. If $DB = 4.5$ and $D'B' = 18$, the scale factor of this dilation is

(1) $\frac{1}{5}$

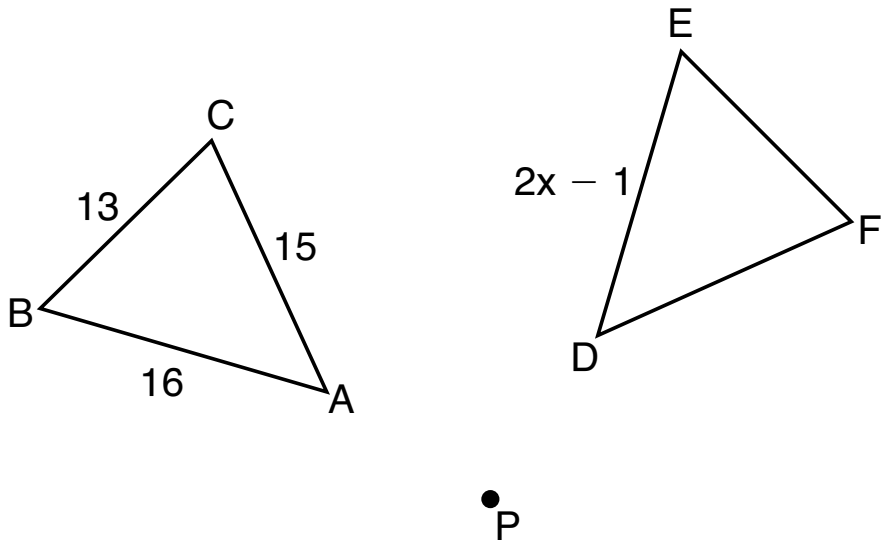
(2) 5

(3) $\frac{1}{4}$

(4) 4

Use this space for computations.

2 In the diagram below, $\triangle ABC$ with sides of 13, 15, and 16, is mapped onto $\triangle DEF$ after a clockwise rotation of 90° about point P.



If $DE = 2x - 1$, what is the value of x?

(1) 7

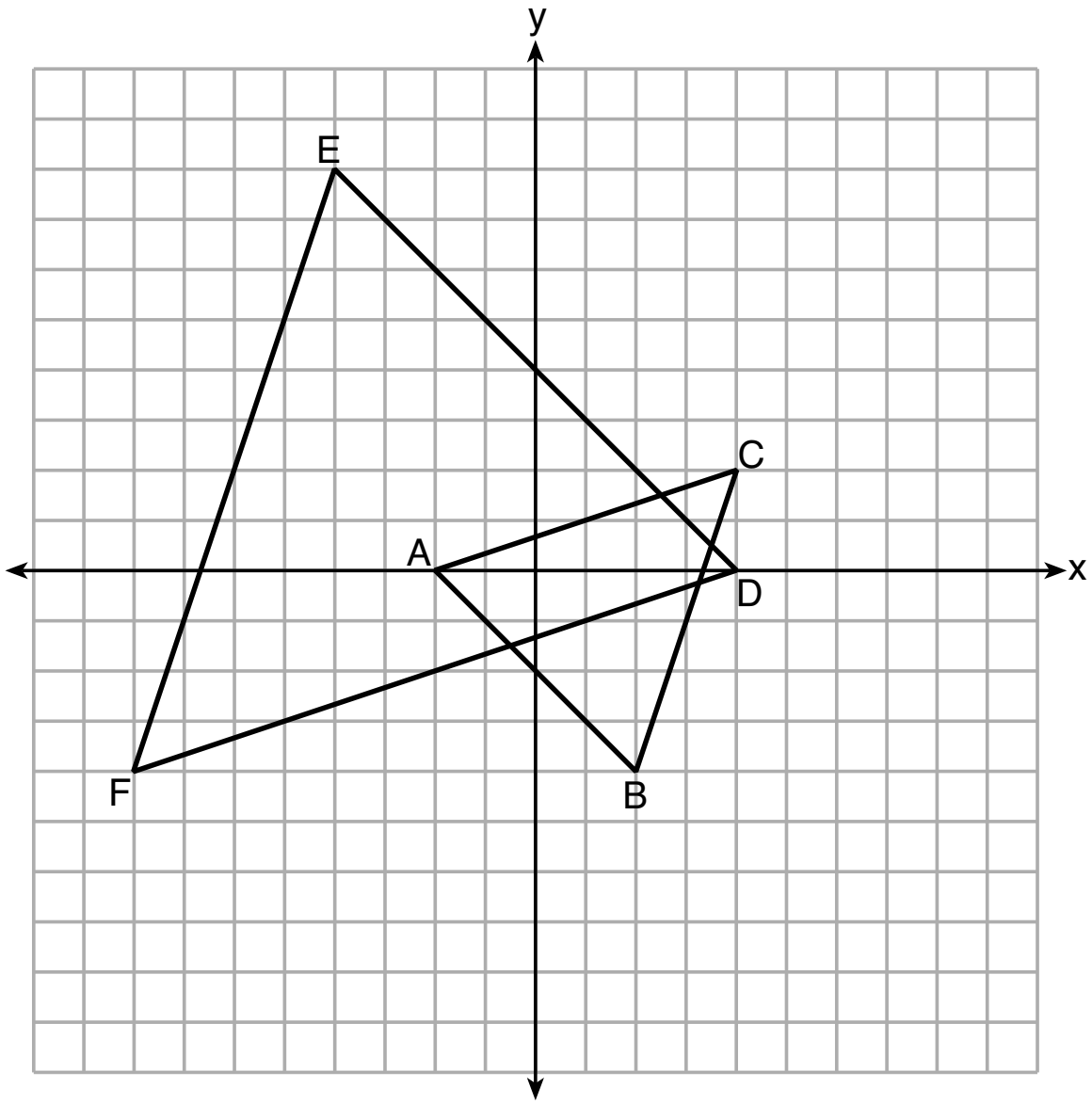
(2) 7.5

(3) 8

(4) 8.5

Use this space for computations.

3 On the set of axes below, $\triangle ABC$ has vertices at $A(-2,0)$, $B(2,-4)$, $C(4,2)$, and $\triangle DEF$ has vertices at $D(4,0)$, $E(-4,8)$, $F(-8,-4)$.



Question 3 is continued on the next page.

Use this space for computations.

Which sequence of transformations will map $\triangle ABC$ onto $\triangle DEF$?

(1) a dilation of $\triangle ABC$ by a scale factor of 2 centered at point A

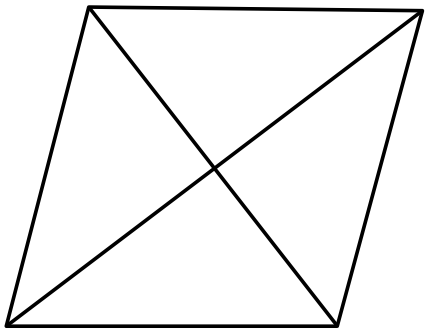
(2) a dilation of $\triangle ABC$ by a scale factor of $\frac{1}{2}$ centered at point A

(3) a dilation of $\triangle ABC$ by a scale factor of 2 centered at the origin, followed by a rotation of 180° about the origin

(4) a dilation of $\triangle ABC$ by a scale factor of $\frac{1}{2}$ centered at the origin, followed by a rotation of 180° about the origin

Use this space for computations.

4 The figure below shows a rhombus with noncongruent diagonals.



Which transformation would *not* carry this rhombus onto itself?

(1) a reflection over the shorter diagonal

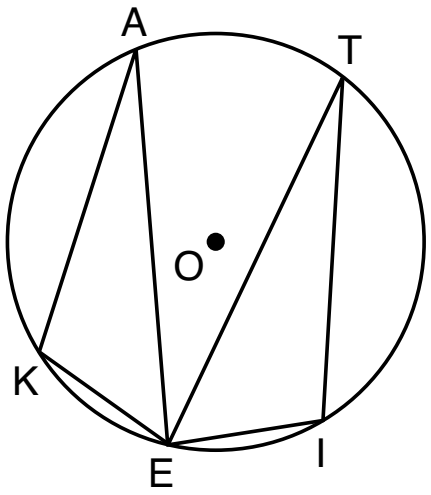
(2) a reflection over the longer diagonal

(3) a clockwise rotation of 90° about the intersection of the diagonals

(4) a counterclockwise rotation of 180° about the intersection of the diagonals

Use this space for computations.

5 In the diagram below of circle O, points K, A, T, I, and E are on the circle, $\triangle KAE$ and $\triangle ITE$ are drawn, $\overset{\frown}{KE} \cong \overset{\frown}{EI}$, and $\angle EKA \cong \angle EIT$.



Which statement about $\triangle KAE$ and $\triangle ITE$ is always true?

(1) They are neither congruent nor similar.

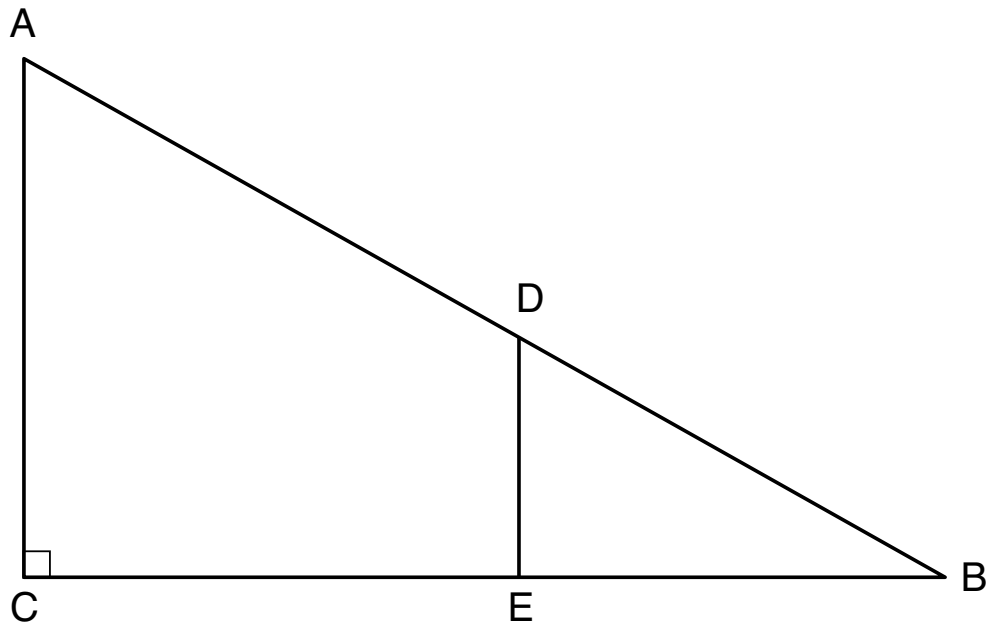
(2) They are similar but not congruent.

(3) They are right triangles.

(4) They are congruent.

Use this space for computations.

6 In right triangle ABC shown below, point D is on $\overline{AB}$ and point E is on $\overline{CB}$ such that $\overline{AC} \| \overline{DE}$.



If $AB = 15$, $BC = 12$, and $EC = 7$, what is the length of $\overline{BD}$?

(1) 8.75

(2) 6.25

(3) 5

(4) 4

Use this space for computations.

7 In rhombus $VENU$, diagonals $\overline{VN}$ and $\overline{EU}$ intersect at S. If $VN = 12$ and $EU = 16$, what is the perimeter of the rhombus?

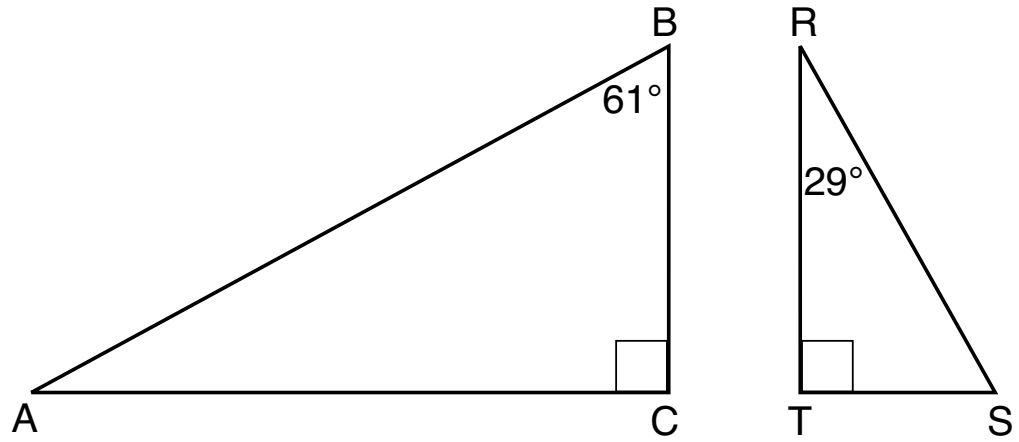
(1) 80

(2) 40

(3) 20

(4) 10

8 Given right triangle ABC with a right angle at C, $m\angle B = 61°$. Given right triangle RST with a right angle at T, $m\angle R = 29°$.



Which proportion in relation to $\triangle ABC$ and $\triangle RST$ is *not* correct?

(1) $\frac{AB}{RS} = \frac{RT}{AC}$

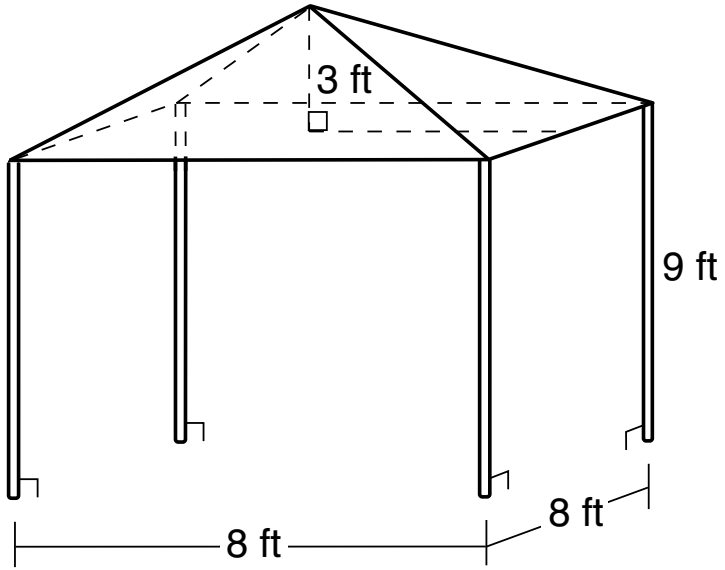
(2) $\frac{BC}{ST} = \frac{AB}{RS}$

(3) $\frac{BC}{ST} = \frac{AC}{RT}$

(4) $\frac{AB}{AC} = \frac{RS}{RT}$

Use this space for computations.

9 A vendor is using an 8-ft by 8-ft tent for a craft fair. The legs of the tent are 9 ft tall and the top forms a square pyramid with a height of 3 ft.



What is the volume, in cubic feet, of space the tent occupies?

(1) 256

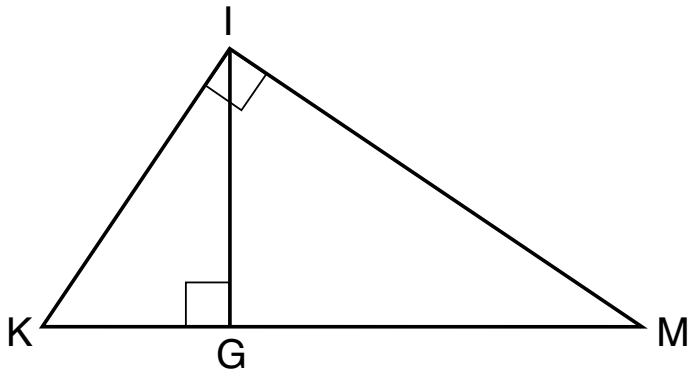
(2) 640

(3) 672

(4) 768

Use this space for computations.

10 In the diagram below of right triangle KMI, altitude $\overline{IG}$ is drawn to hypotenuse $\overline{KM}$.



If $KG = 9$ and $IG = 12$, the length of $\overline{IM}$ is

(1) 15

(2) 16

(3) 20

(4) 25

Use this space for computations.

11 Which three-dimensional figure will result when a rectangle 6 inches long and 5 inches wide is continuously rotated about the longer side?

(1) a rectangular prism with a length of 6 inches, width of 6 inches, and height of 5 inches

(2) a rectangular prism with a length of 6 inches, width of 5 inches, and height of 5 inches

(3) a cylinder with a radius of 5 inches and a height of 6 inches

(4) a cylinder with a radius of 6 inches and a height of 5 inches

12 Which statement about parallelograms is always true?

(1) The diagonals are congruent.

(2) The diagonals bisect each other.

(3) The diagonals are perpendicular.

(4) The diagonals bisect their respective angles.

Use this space for computations.

13 From a point on the ground one-half mile from the base of a historic monument, the angle of elevation to its top is 11.87°. To the *nearest foot*, what is the height of the monument?

(1) 543

(2) 555

(3) 1086

(4) 1110

14 The area of a sector of a circle with a radius measuring 15 cm is 75π cm^2. What is the measure of the central angle that forms the sector?

(1) 72°

(2) 120°

(3) 144°

(4) 180°

15 Point M divides $\overline{AB}$ so that $AM{:}MB = 1{:}2$. If A has coordinates $(-1,-3)$ and B has coordinates $(8,9)$, the coordinates of M are

(1) $(2,1)$

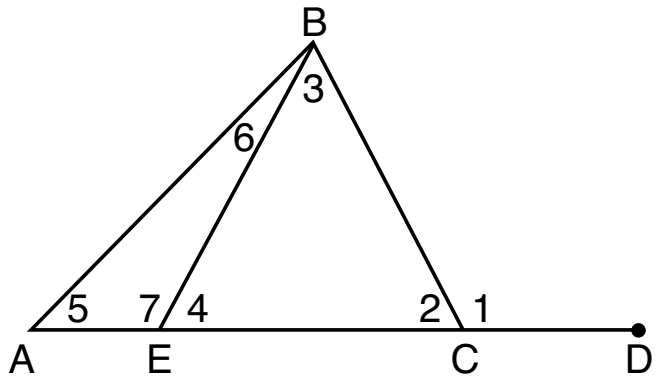
(2) $\left(\frac{5}{3},0\right)$

(3) $(5,5)$

(4) $\left(\frac{23}{3},8\right)$

Use this space for computations.

16 In the diagram below of triangle ABC, $\overline{AC}$ is extended through point C to point D, and $\overline{BE}$ is drawn to $\overline{AC}$.



Which equation is always true?

(1) $m\angle 1 = m\angle 3 + m\angle 2$

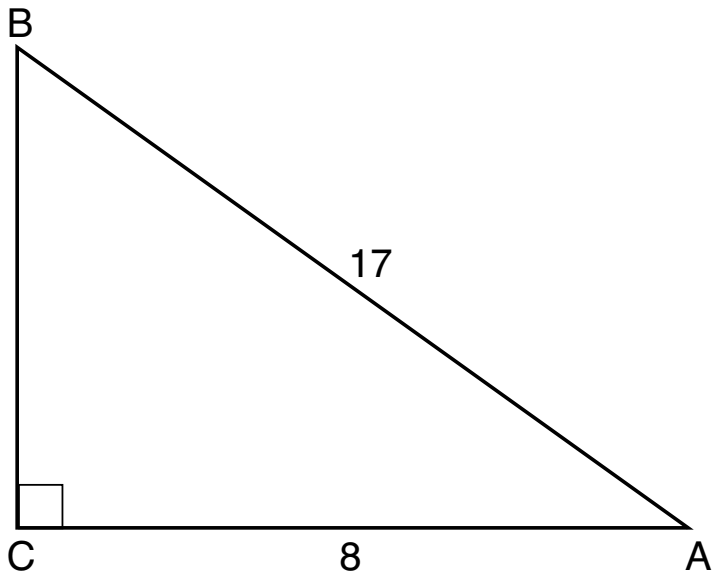
(2) $m\angle 5 = m\angle 3 - m\angle 2$

(3) $m\angle 6 = m\angle 3 - m\angle 2$

(4) $m\angle 7 = m\angle 3 + m\angle 2$

Use this space for computations.

17 In the diagram below of right triangle ABC, $AC = 8$, and $AB = 17$.



Which equation would determine the value of angle A?

(1) $\sin A = \frac{8}{17}$

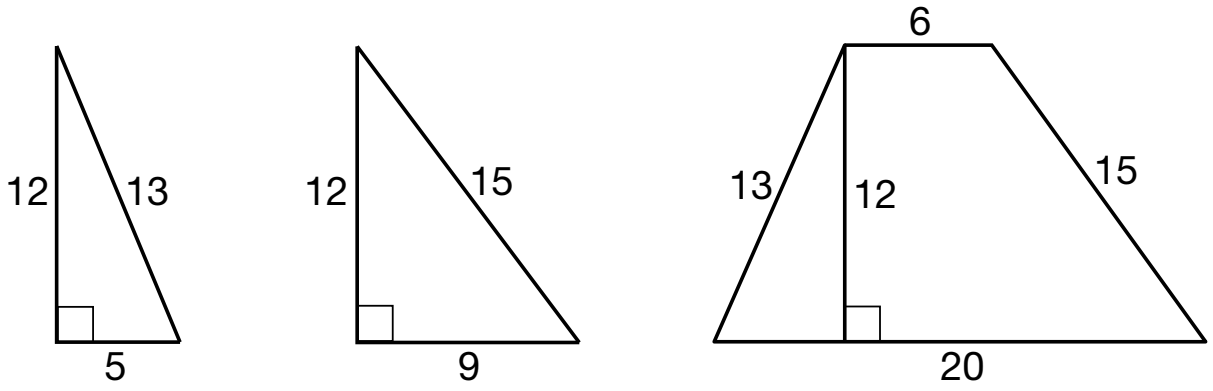
(2) $\tan A = \frac{8}{15}$

(3) $\cos A = \frac{15}{17}$

(4) $\tan A = \frac{15}{8}$

Use this space for computations.

18 Francisco needs the three pieces of glass shown below to complete a stained glass window. The shapes, two triangles and a trapezoid, are measured in inches.



Glass can be purchased in rectangular sheets that are 12 inches wide. What is the minimum length of a sheet of glass, in inches, that Francisco must purchase in order to have enough to complete the window?

(1) 20

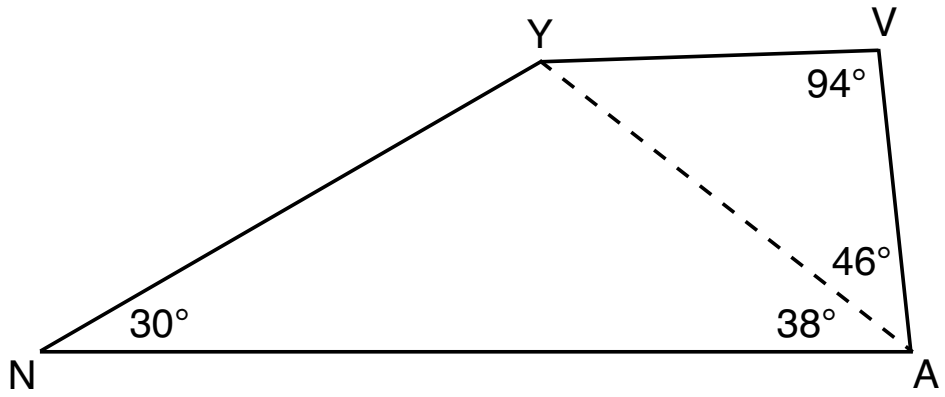
(2) 25

(3) 29

(4) 34

Use this space for computations.

19 In the diagram of quadrilateral $NAVY$ below, $m\angle YNA = 30°$, $m\angle YAN = 38°$, $m\angle AVY = 94°$, and $m\angle VAY = 46°$.



Which segment has the shortest length?

(1) $\overline{AY}$

(2) $\overline{NY}$

(3) $\overline{VA}$

(4) $\overline{VY}$

20 What is an equation of a circle whose center is (1,4) and diameter is 10?

(1) $x^2 - 2x + y^2 - 8y = 8$

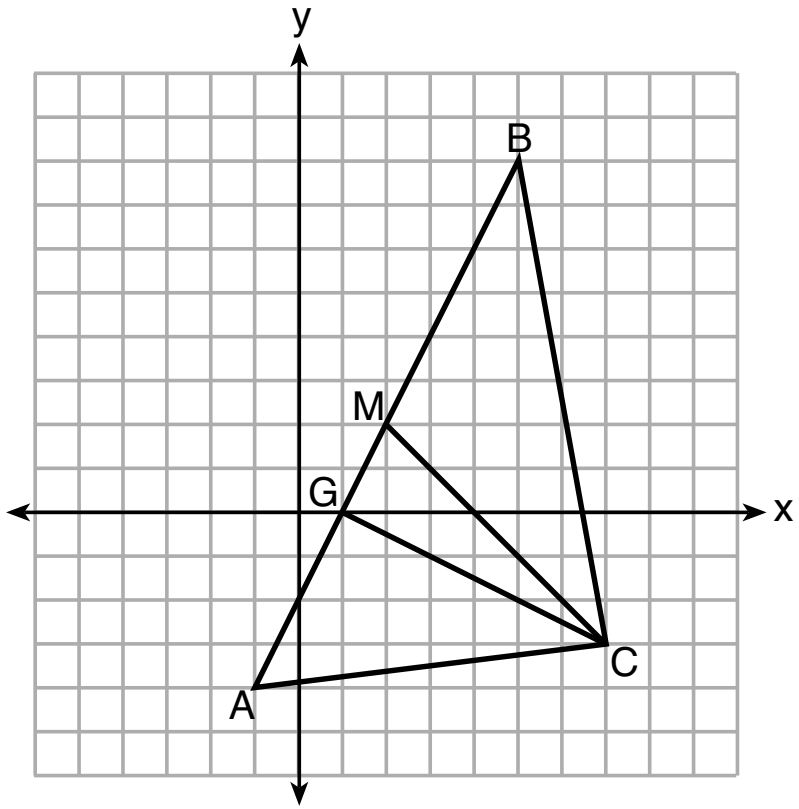
(2) $x^2 + 2x + y^2 + 8y = 8$

(3) $x^2 - 2x + y^2 - 8y = 83$

(4) $x^2 + 2x + y^2 + 8y = 83$

Use this space for computations.

21 On the set of axes below, $\triangle ABC$, altitude $\overline{CG}$, and median $\overline{CM}$ are drawn.



Which expression represents the area of $\triangle ABC$?

(1) $\frac{(BC)(AC)}{2}$

(2) $\frac{(GC)(BC)}{2}$

(3) $\frac{(CM)(AB)}{2}$

(4) $\frac{(GC)(AB)}{2}$

Use this space for computations.

22 In right triangle ABC, $m\angle C = 90°$ and $AC \neq BC$. Which trigonometric ratio is equivalent to $\sin B$?

(1) $\cos A$

(2) $\cos B$

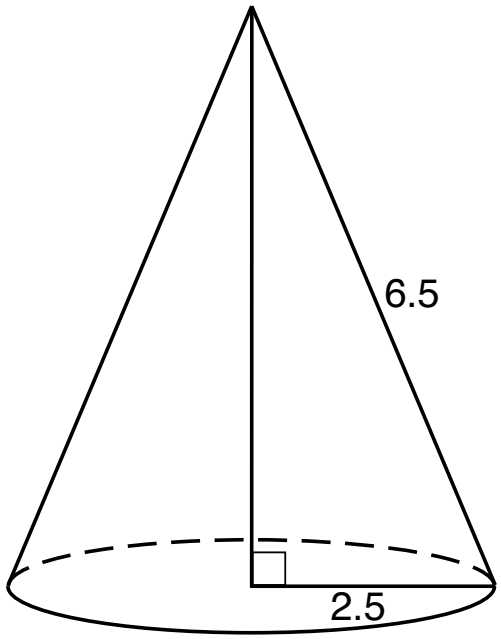
(3) $\tan A$

(4) $\tan B$

GO RIGHT ON TO THE NEXT PAGE ⇨

Use this space for computations.

23 As shown in the diagram below, the radius of a cone is 2.5 cm and its slant height is 6.5 cm.



How many cubic centimeters are in the volume of the cone?

(1) 12.5π

(2) 13.5π

(3) 30.0π

(4) 37.5π

Use this space for computations.

24 What is an equation of the image of the line $y = \frac{3}{2}x - 4$ after a dilation of a scale factor of $\frac{3}{4}$ centered at the origin?

(1) $y = \frac{9}{8}x - 4$

(2) $y = \frac{9}{8}x - 3$

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

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

GO RIGHT ON TO THE NEXT PAGE ⇨

Part II

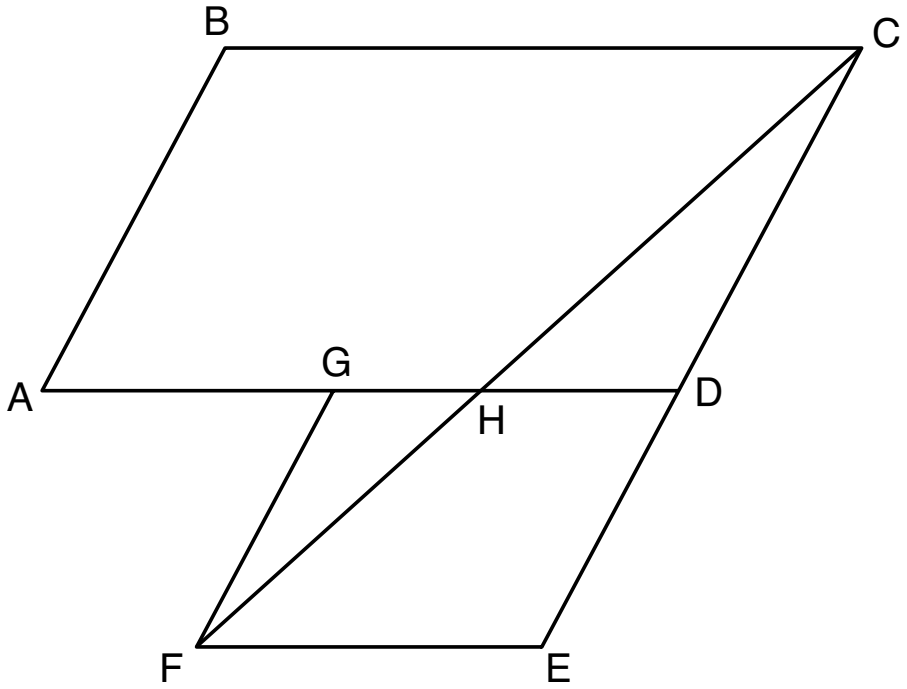
Answer all 7 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily 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 Write an equation of the line that is parallel to the line whose equation is $3y + 7 = 2x$ and passes through the point (2,6).

Work space for question 25 is continued on the next page.

Question 25 continued

26 Parallelogram $ABCD$ is adjacent to rhombus $DEFG$, as shown below, and $\overline{FC}$ intersects $\overline{AGD}$ at H.

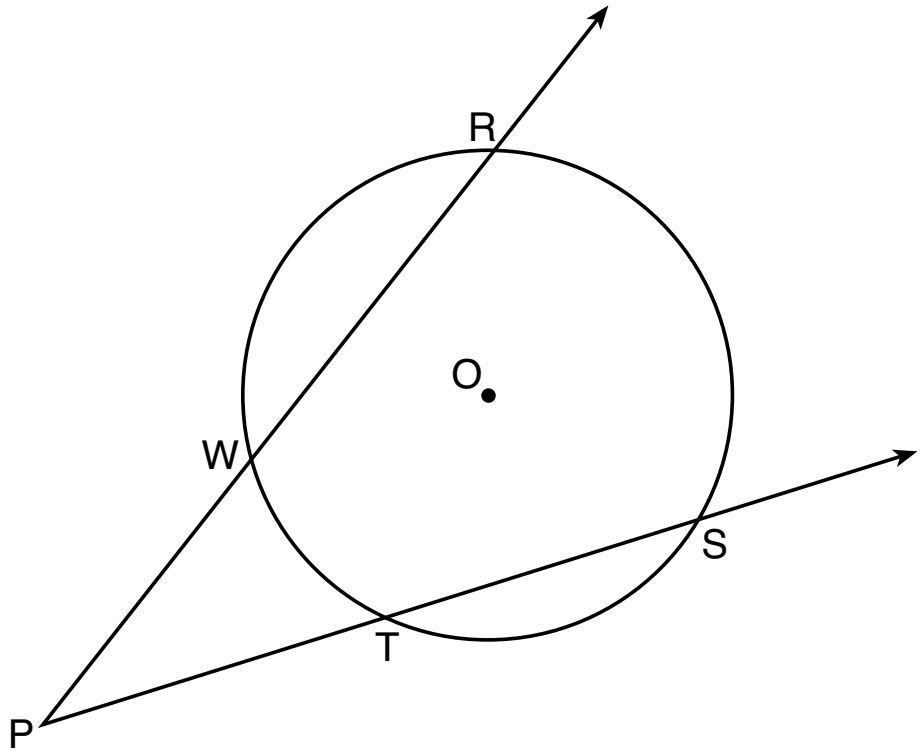


If $m\angle B = 118°$ and $m\angle AHC = 138°$, determine and state $m\angle GFH$.

Work space for question 26 is continued on the next page.

Question 26 continued

27 As shown in the diagram below, secants $\overrightarrow{PWR}$ and $\overrightarrow{PTS}$ are drawn to circle O from external point P.

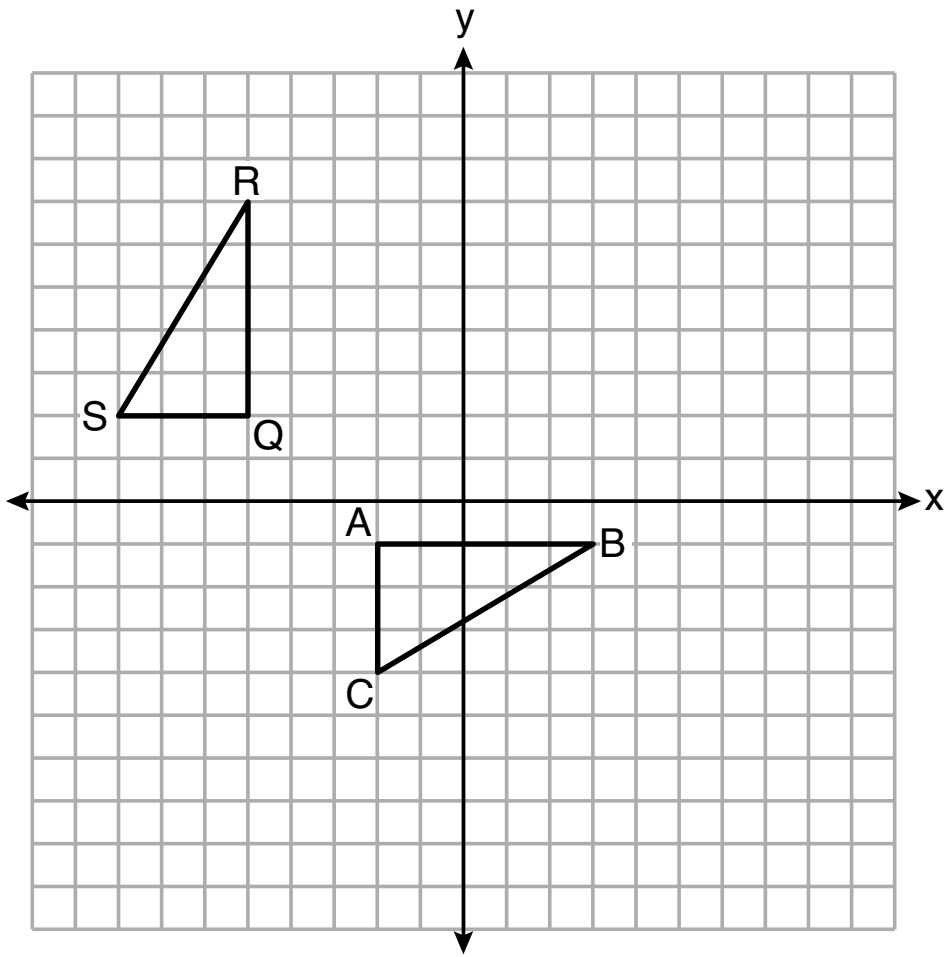


If $m\angle RPS = 35°$ and $m\overset{\frown}{RS} = 121°$, determine and state $m\overset{\frown}{WT}$.

Work space for question 27 is continued on the next page.

Question 27 continued

28 On the set of axes below, $\triangle ABC$ is graphed with coordinates $A(-2,-1)$, $B(3,-1)$, and $C(-2,-4)$. Triangle QRS, the image of $\triangle ABC$, is graphed with coordinates $Q(-5,2)$, $R(-5,7)$, and $S(-8,2)$.

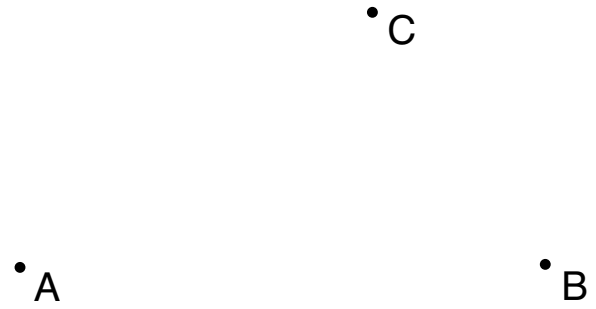


Question 28 is continued on the next page.

Question 28 continued

Describe a sequence of transformations that would map $\triangle ABC$ onto $\triangle QRS$.

29 Given points A, B, and C, use a compass and straightedge to construct point D so that $ABCD$ is a parallelogram. [Leave all construction marks.]



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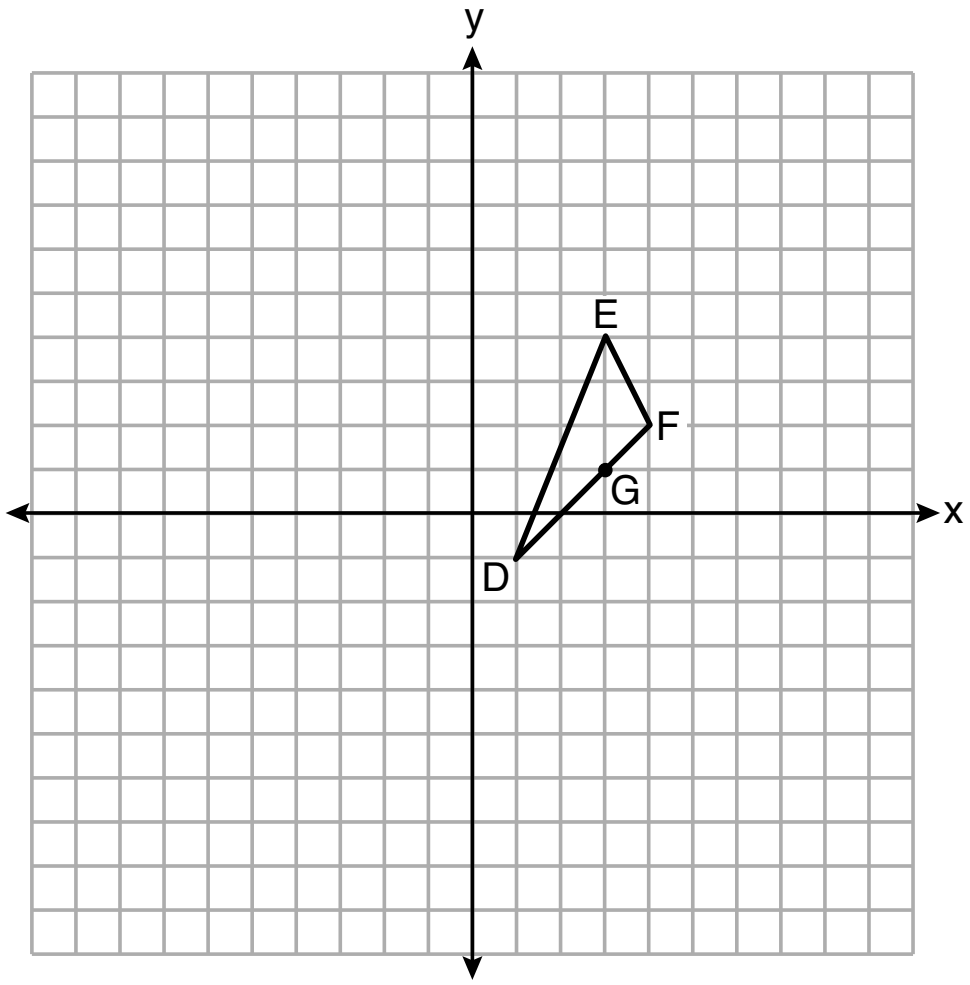
30 On the set of axes below, $\triangle DEF$ has vertices at the coordinates $D(1,-1)$, $E(3,4)$, and $F(4,2)$, and point G has coordinates $(3,1)$. Owen claims the median from point E must pass through point G.

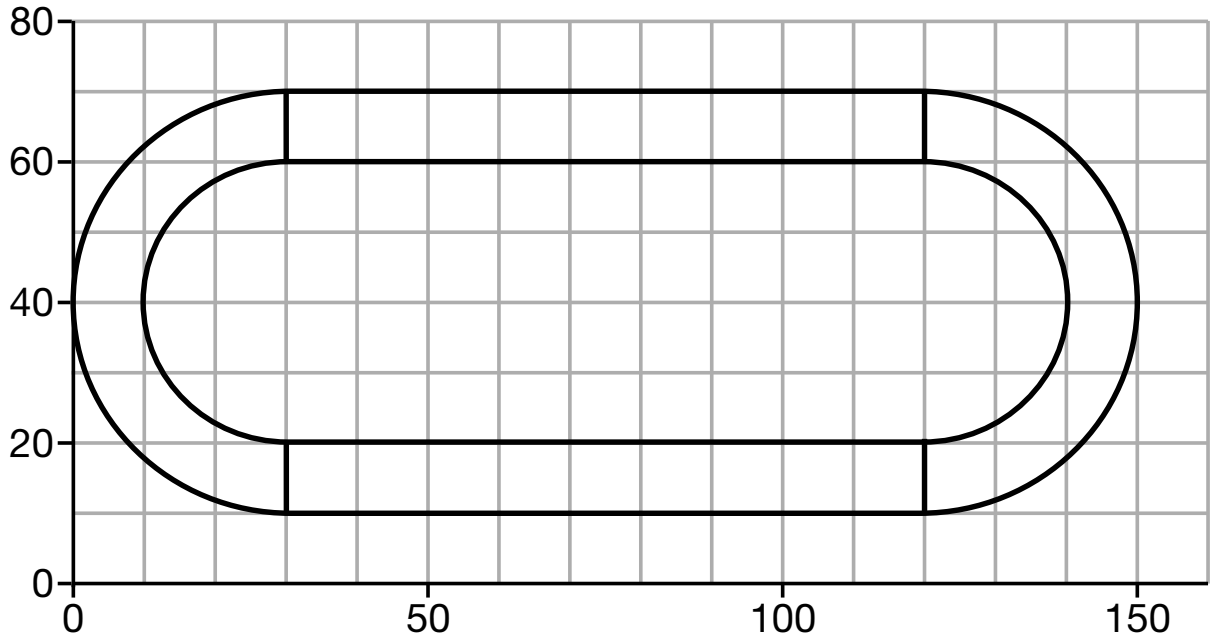
Is Owen correct? Explain why.



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

Question 30 continued

31 A walking path at a local park is modeled on the grid below, where the length of each grid square is 10 feet. The town needs to submit paperwork to pave the walking path. Determine and state, to the *nearest square foot*, the area of the walking path.



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]

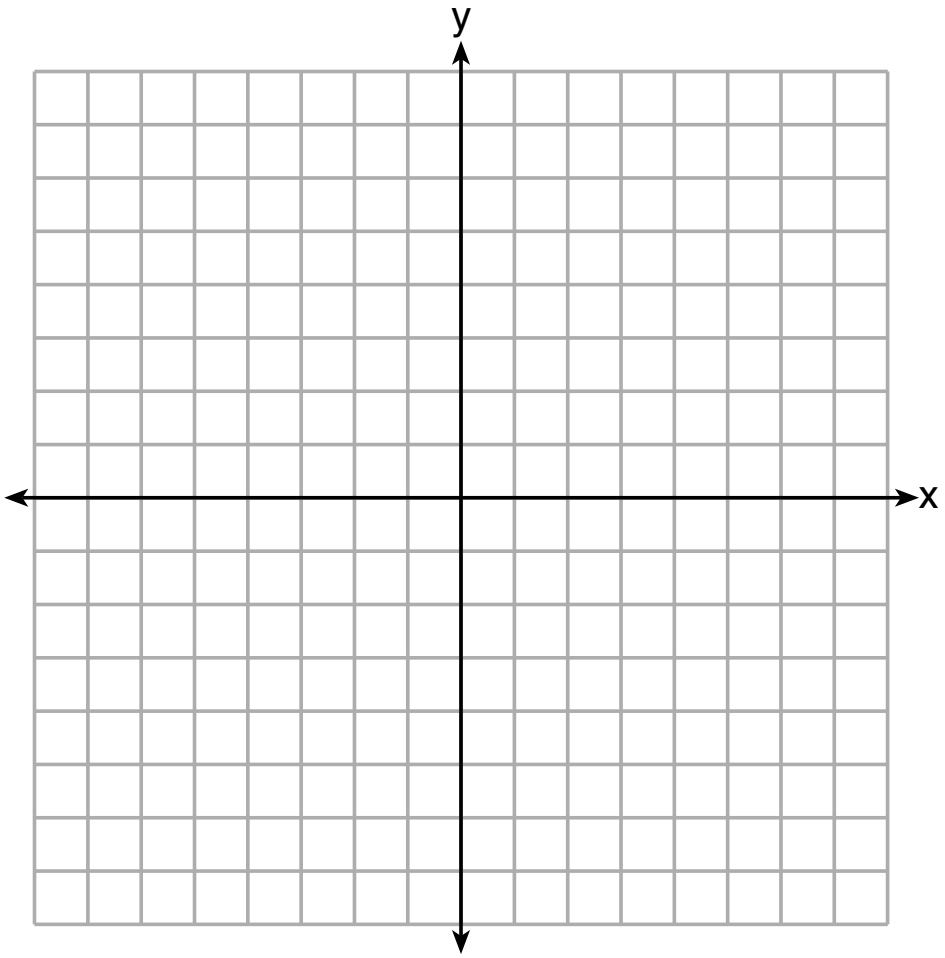
32 A triangle has vertices $A(-2,4)$, $B(6,2)$, and $C(1,-1)$.

Prove that $\triangle ABC$ is an isosceles right triangle.

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

The set of axes for question 32 is on the next page.

Question 32 continued



33 Theresa has a rectangular pool 30 ft long, 15 ft wide, and 4 ft deep. Theresa fills her pool using city water at a rate of $3.95 per 100 gallons of water.

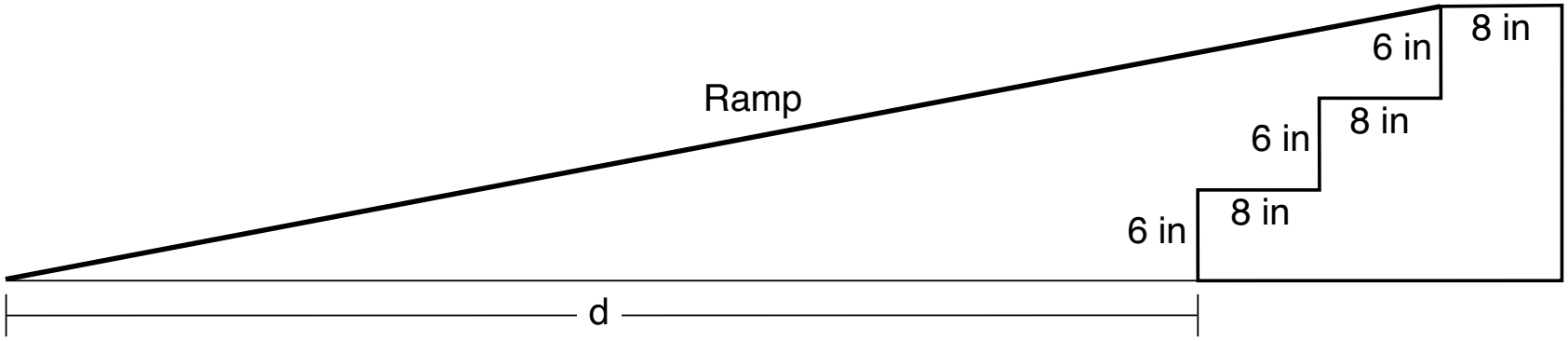
Nancy has a circular pool with a diameter of 24 ft and a depth of 4 ft. Nancy fills her pool with a water delivery service at a rate of $200 per 6000 gallons.

If Theresa and Nancy both fill their pools 6 inches from the top of the pool, determine and state who paid more to fill her pool. [1 ft^3 water = 7.48 gallons]

Work space for question 33 is continued on the next page.

Question 33 continued

34 As modeled in the diagram below, an access ramp starts on flat ground and ends at the beginning of the top step. Each step is 6 inches tall and 8 inches deep.



If the angle of elevation of the ramp is 4.76°, determine and state the length of the ramp, to the *nearest tenth of a foot*.

Question 34 is continued on the next page.

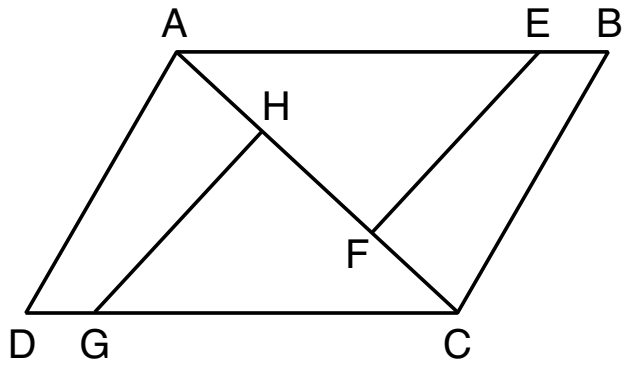
Question 34 continued

Determine and state, to the *nearest tenth of a foot*, the horizontal distance, d, from the bottom of the stairs to the bottom of the ramp.

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 for the question to determine your answer. Note that diagrams are not necessarily drawn to scale. For the question 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. [6]

35 In the diagram of quadrilateral $ABCD$ with diagonal $\overline{AC}$ shown below, segments GH and EF are drawn, $\overline{AE} \cong \overline{CG}$, $\overline{BE} \cong \overline{DG}$, $\overline{AH} \cong \overline{CF}$, and $\overline{AD} \cong \overline{CB}$.



Prove: $\overline{EF} \cong \overline{GH}$

Work space for question 35 is continued on the next page.

Question 35 continued

Work space for question 35 is continued on the next page.

Question 35 continued

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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	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ 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	$A = A_0 e^{k(t - t_0)} + B_0$