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

GEOMETRY

Friday, August 17, 2018 — 12:30 to 3:30 p.m., only

Student Name: Mr. Sibol

School Name: JMAP

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. This sheet is perforated so you may remove it 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 perforated 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.

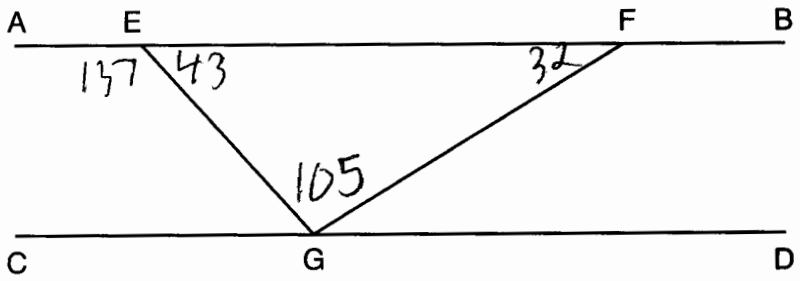
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

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 In the diagram below, $\overline{AEFB} \parallel \overline{CGD}$, and $\overline{GE}$ and $\overline{GF}$ are drawn.



If $m\angle EFG = 32°$ and $m\angle AEG = 137°$, what is $m\angle EGF$?

(1) 11°
(2) 43°
(3) 75°
(4) 105°

2 If $\triangle ABC$ is mapped onto $\triangle DEF$ after a line reflection and $\triangle DEF$ is mapped onto $\triangle XYZ$ after a translation, the relationship between $\triangle ABC$ and $\triangle XYZ$ is that they are always

(1) congruent and similar
(2) congruent but not similar
(3) similar but not congruent
(4) neither similar nor congruent

reflections & translations preserve distance

Use this space for computations.

3 An isosceles right triangle whose legs measure 6 is continuously rotated about one of its legs to form a three-dimensional object. The three-dimensional object is a

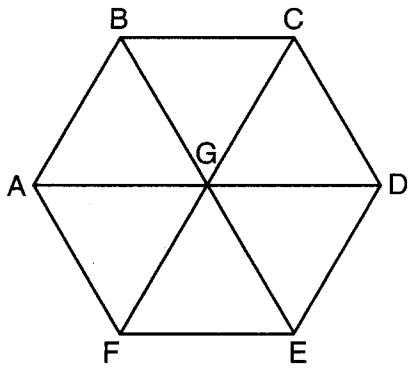
(1) cylinder with a diameter of 6

(2) cylinder with a diameter of 12

(3) cone with a diameter of 6

(4) cone with a diameter of 12

4 In regular hexagon $ABCDEF$ shown below, $\overline{AD}$, $\overline{BE}$, and $\overline{CF}$ all intersect at G.



When $\triangle ABG$ is reflected over $\overline{BG}$ and then rotated 180° about point G, $\triangle ABG$ is mapped onto

(1) $\triangle FEG$

(2) $\triangle AFG$

(3) $\triangle CBG$

(4) $\triangle DEG$

5 A right cylinder is cut perpendicular to its base. The shape of the cross section is a

(1) circle

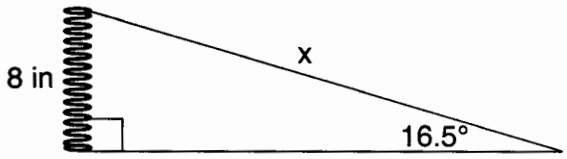
(2) cylinder

(3) rectangle

(4) triangular prism

Use this space for computations.

6 Yolanda is making a springboard to use for gymnastics. She has 8-inch-tall springs and wants to form a 16.5° angle with the base, as modeled in the diagram below.



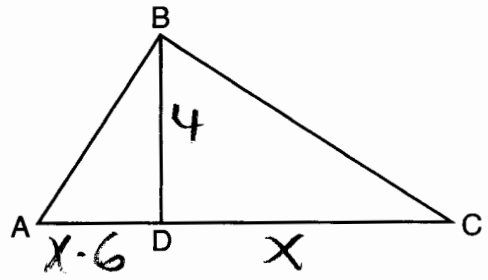
$\sin 16.5 = \frac{8}{x}$

$x \approx 28.2$

To the *nearest tenth of an inch*, what will be the length of the springboard, x?

(1) 2.3
(2) 8.3
(3) 27.0
(4) 28.2

7 In the diagram below of right triangle ABC, altitude $\overline{BD}$ is drawn to hypotenuse $\overline{AC}$.



$x(x-6) = 4^2$

$x^2 - 6x - 16 = 0$

$(x-8)(x+2) = 0$

$x = 8$

If $BD = 4$, $AD = x - 6$, and $CD = x$, what is the length of $\overline{CD}$?

(1) 5
(2) 2
(3) 8
(4) 11

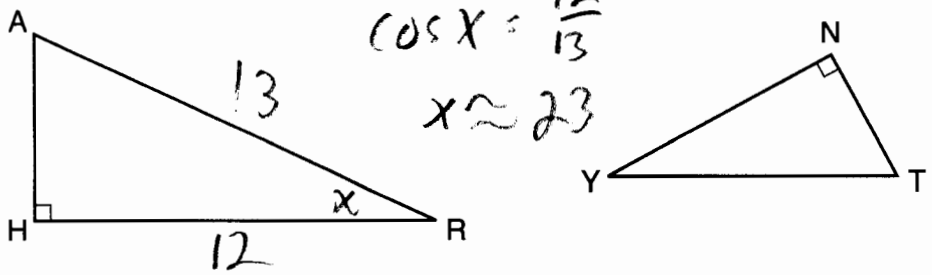
8 Rhombus $STAR$ has vertices $S(-1,2)$, $T(2,3)$, $A(3,0)$, and $R(0,-1)$. What is the perimeter of rhombus $STAR$?

$\sqrt{(-1-2)^2+(2-3)^2} = \sqrt{10}$

(1) $\sqrt{34}$
(2) $4\sqrt{34}$
(3) $\sqrt{10}$
(4) $4\sqrt{10}$

Use this space for computations.

9 In the diagram below of $\triangle HAR$ and $\triangle NTY$, angles H and N are right angles, and $\triangle HAR \sim \triangle NTY$.



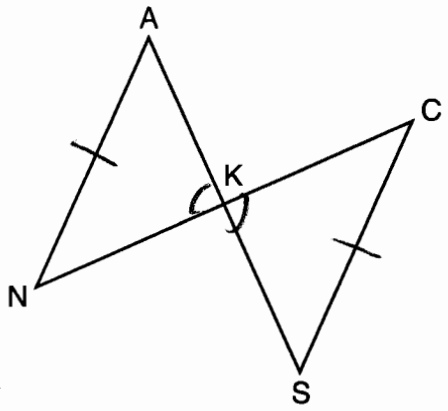
$\cos X = \frac{12}{13}$

$x \approx 23$

If $AR = 13$ and $HR = 12$, what is the measure of angle Y, to the *nearest degree*?

(1) 23°
(2) 25°
(3) 65°
(4) 67°

10 In the diagram below, $\overline{AKS}$, $\overline{NKC}$, $\overline{AN}$, and $\overline{SC}$ are drawn such that $\overline{AN} \cong \overline{SC}$.



Which additional statement is sufficient to prove $\triangle KAN \cong \triangle KSC$ by AAS?

(1) $\overline{AS}$ and $\overline{NC}$ bisect each other. SSA
(2) K is the midpoint of $\overline{NC}$. SSA
(3) $\overline{AS} \perp \overline{CN}$ Can't use HL as no L
(4) $\overline{AN} \parallel \overline{SC}$ Can use AIAs

Use this space for computations.

11 Which equation represents a line that is perpendicular to the line represented by $y = \frac{2}{3}x + 1$?

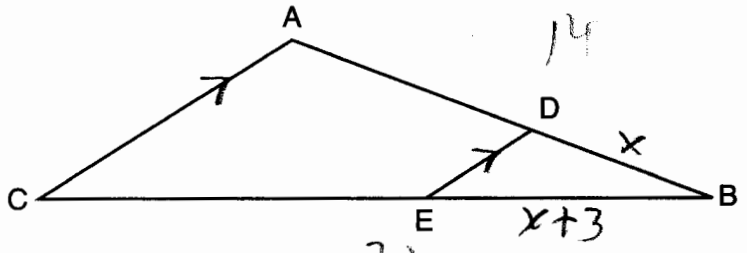
(1) $3x + 2y = 12$

(2) $3x - 2y = 12$

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

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

12 In the diagram of $\triangle ABC$ below, points D and E are on sides $\overline{AB}$ and $\overline{CB}$ respectively, such that $\overline{DE} \parallel \overline{AC}$.



If EB is 3 more than DB, $AB = 14$, and $CB = 21$, what is the length of $\overline{AD}$?

(1) 6

(2) 8

(3) 9

(4) 12

13 Quadrilateral $MATH$ has both pairs of opposite sides congruent and parallel. Which statement about quadrilateral $MATH$ is always true?

(1) $\overline{MT} \cong \overline{AH}$

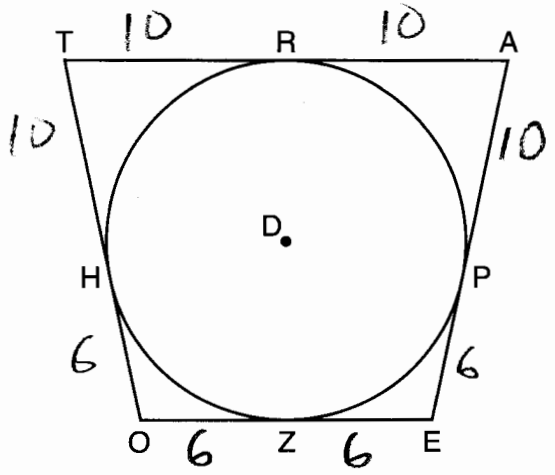
(2) $\overline{MT} \perp \overline{AH}$

(3) $\angle MHT \cong \angle ATH$

(4) $\angle MAT \cong \angle MHT$

Use this space for computations.

14 In the figure shown below, quadrilateral $TAEO$ is circumscribed around circle D. The midpoint of $\overline{TA}$ is R, and $\overline{HO} \cong \overline{PE}$.



If $AP = 10$ and $EO = 12$, what is the perimeter of quadrilateral $TAEO$?

(1) 56
(2) 64
(3) 72
(4) 76

15 The coordinates of the endpoints of directed line segment ABC are $A(-8,7)$ and $C(7,-13)$. If $AB:BC = 3:2$, the coordinates of B are

(1) $(1,-5)$
(2) $(-2,-1)$
(3) $(-3,0)$
(4) $(3,-6)$

$-8 + \frac{3}{5}(7 - -8)$

$-8 + 9$

1

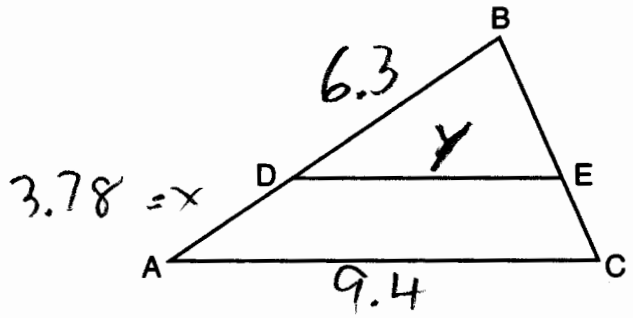
$7 + \frac{3}{5}(-13 - 7)$

$7 - 12$

-5

Use this space for computations.

16 In triangle ABC, points D and E are on sides $\overline{AB}$ and $\overline{BC}$, respectively, such that $\overline{DE} \parallel \overline{AC}$, and $AD:DB = 3:5$.



$\frac{3}{5} = \frac{x}{6.3}$

If $DB = 6.3$ and $AC = 9.4$, what is the length of $\overline{DE}$, to the *nearest tenth*?

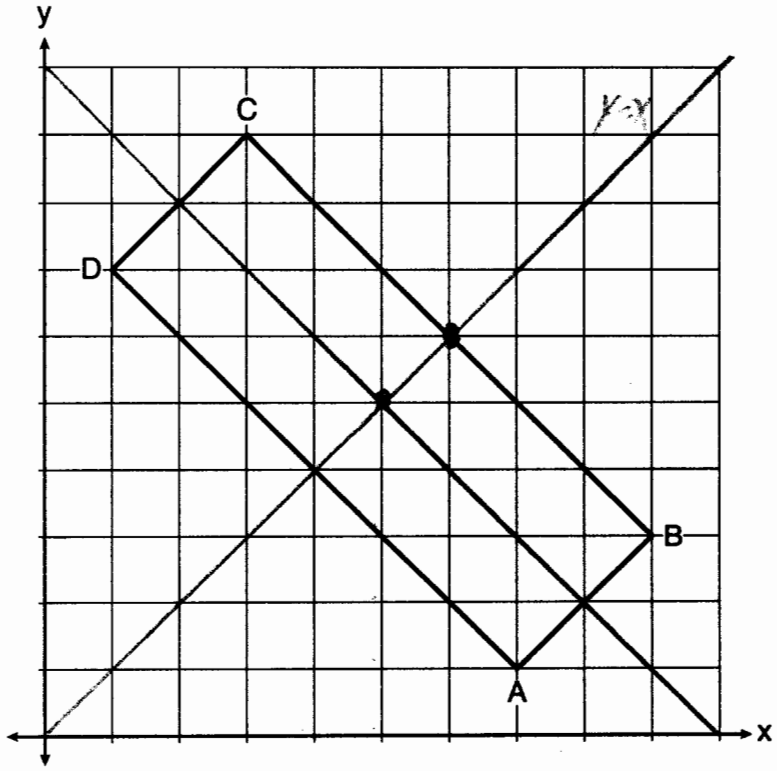
(1) 3.8
(2) 5.6
(3) 5.9
(4) 15.7

$\frac{y}{9.4} = \frac{6.3}{10.08}$

$y \approx 5.9$

Use this space for computations.

17 In the diagram below, rectangle $ABCD$ has vertices whose coordinates are $A(7,1)$, $B(9,3)$, $C(3,9)$, and $D(1,7)$.



Which transformation will *not* carry the rectangle onto itself?

(1) a reflection over the line $y = x$

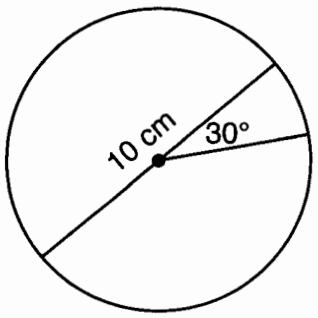
(2) a reflection over the line $y = -x + 10$

(3) a rotation of 180° about the point (6,6)

(4) a rotation of 180° about the point (5,5)

Use this space for computations.

18 A circle with a diameter of 10 cm and a central angle of 30° is drawn below.



$\frac{30}{360} \cdot \pi \cdot 5^2 \approx 6.5$

What is the area, to the *nearest tenth of a square centimeter*, of the sector formed by the 30° angle?

(1) 5.2
(2) 6.5
(3) 13.1
(4) 26.2

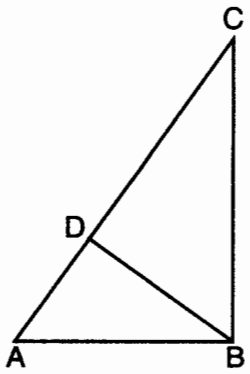
19 A child's tent can be modeled as a pyramid with a square base whose sides measure 60 inches and whose height measures 84 inches. What is the volume of the tent, to the *nearest cubic foot*?

(1) 35
(2) 58
(3) 82
(4) 175

$\frac{1}{3}(5)^2 \cdot 7 \approx 58$

Use this space for computations.

20 In the accompanying diagram of right triangle ABC, altitude $\overline{BD}$ is drawn to hypotenuse $\overline{AC}$.



Which statement must always be true?

(1) $\frac{AD}{AB} = \frac{BC}{AC}$

(2) $\frac{AD}{AB} = \frac{AB}{AC}$

(3) $\frac{BD}{BC} = \frac{AB}{AD}$

(4) $\frac{AB}{BC} = \frac{BD}{AC}$

21 An equation of circle O is $x^2 + y^2 + 4x - 8y = -16$. The statement that best describes circle O is the

(1) center is $(2,-4)$ and is tangent to the x-axis

(2) center is $(2,-4)$ and is tangent to the y-axis

(3) center is $(-2,4)$ and is tangent to the x-axis

(4) center is $(-2,4)$ and is tangent to the y-axis

$x^2+4x+4+y^2-8y+16=-16+4$

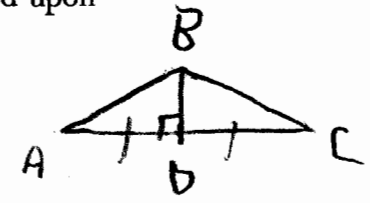
$(x+2)^2+(y-4)^2=4$

22 In $\triangle ABC$, $\overline{BD}$ is the perpendicular bisector of $\overline{ADC}$. Based upon this information, which statements below can be proven?

I. $\overline{BD}$ is a median.

II. $\overline{BD}$ bisects $\angle ABC$.

III. $\triangle ABC$ is isosceles.



(1) I and II, only

(2) I and III, only

(3) II and III, only

(4) I, II, and III

6·3²=54 12·3=36

Use this space for computations.

23 Triangle RJM has an area of 6 and a perimeter of 12. If the triangle is dilated by a scale factor of 3 centered at the origin, what are the area and perimeter of its image, triangle $R'J'M'$?

(1) area of 9 and perimeter of 15

(2) area of 18 and perimeter of 36

(3) area of 54 and perimeter of 36

(4) area of 54 and perimeter of 108

24 If $\sin(2x + 7)° = \cos(4x - 7)°$, what is the value of x?

(1) 7

(2) 15

(3) 21

(4) 30

$2x+7+4x-7=90$

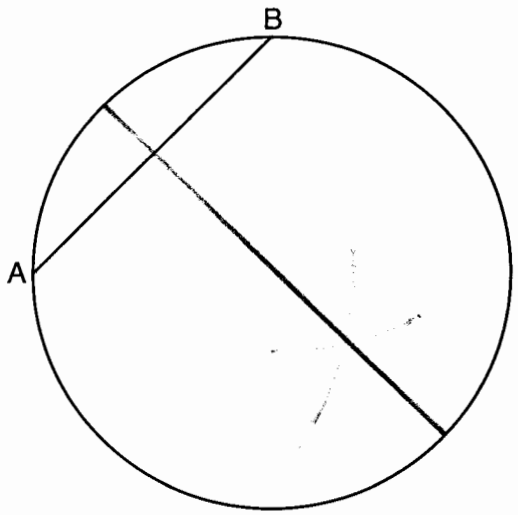
$6x=90$

$x=15$

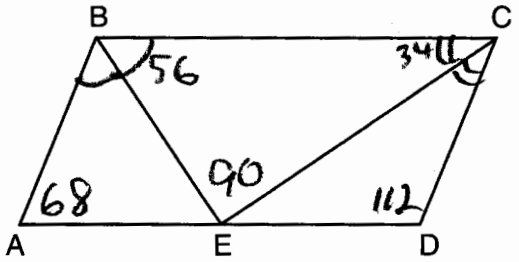
Part II

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 In the circle below, $\overline{AB}$ is a chord. Using a compass and straightedge, construct a diameter of the circle. [Leave all construction marks.]



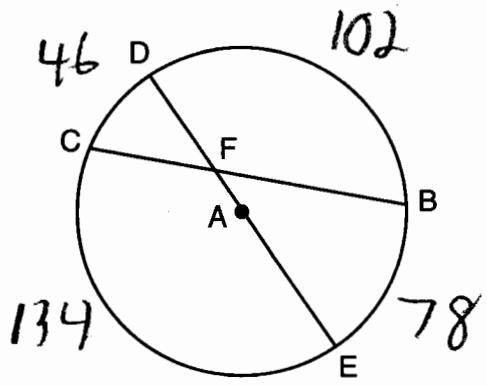
26 In parallelogram $ABCD$ shown below, the bisectors of $\angle ABC$ and $\angle DCB$ meet at E, a point on $\overline{AD}$.



If $m\angle A = 68°$, determine and state $m\angle BEC$.

90°

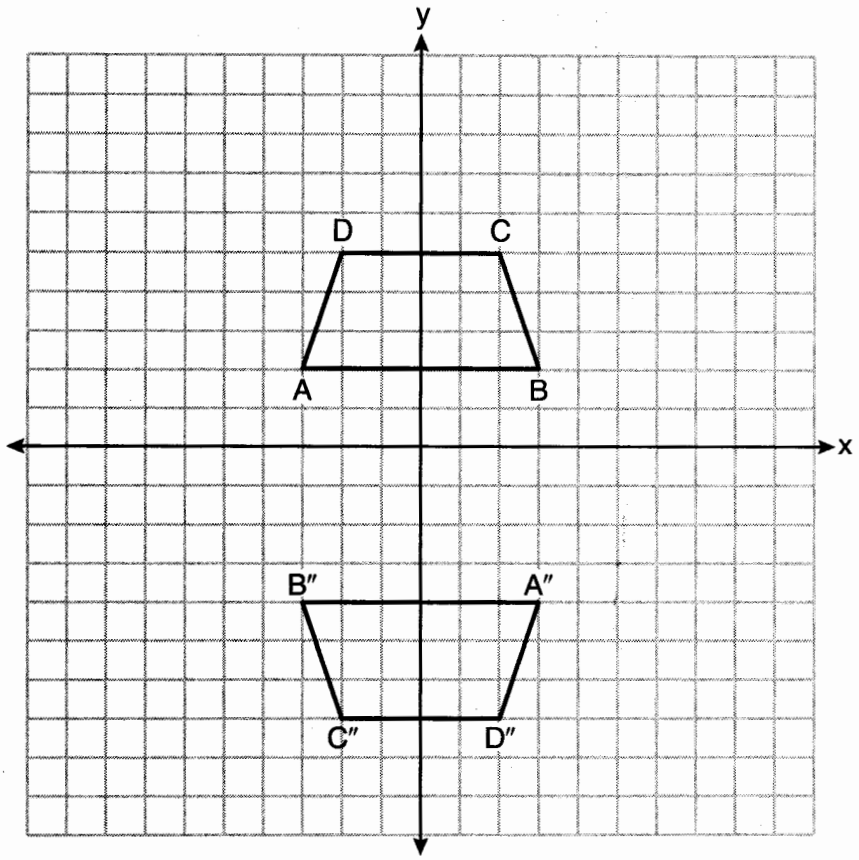
27 In circle A below, chord $\overline{BC}$ and diameter $\overline{DAE}$ intersect at F.



If $m\widehat{CD} = 46°$ and $m\widehat{DB} = 102°$, what is $m\angle CFE$?

$$\frac{134+102}{2} = 118$$

28 Trapezoids *ABCD* and *A″B″C″D″* are graphed on the set of axes below.



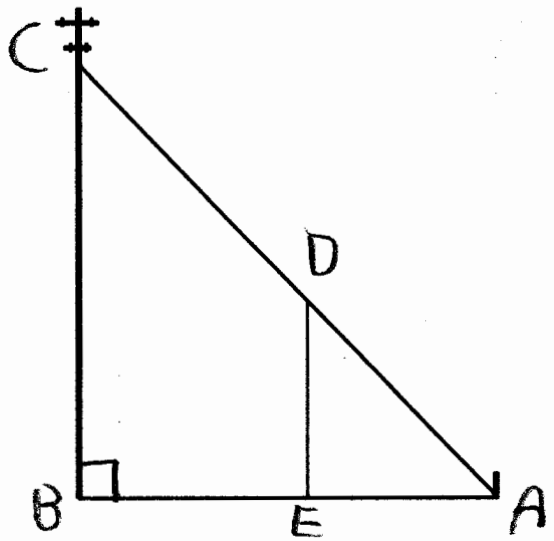
Describe a sequence of transformations that maps trapezoid *ABCD* onto trapezoid *A″B″C″D″*.

rotation 180° about the origin, translation 2 units down

rotation 180° about B, translation 6 units down & 6 units left

reflection over x-axis, translation 2 units down & reflection over y-axis

29 In the model below, a support wire for a telephone pole is attached to the pole and anchored to a stake in the ground 15 feet from the base of the telephone pole. Jamal places a 6-foot wooden pole under the support wire parallel to the telephone pole, such that one end of the pole is on the ground and the top of the pole is touching the support wire. He measures the distance between the bottom of the pole and the stake in the ground.



Jamal says he can approximate how high the support wire attaches to the telephone pole by using similar triangles. Explain why the triangles are similar.

$\triangle ABC \sim \triangle AED$ by AA

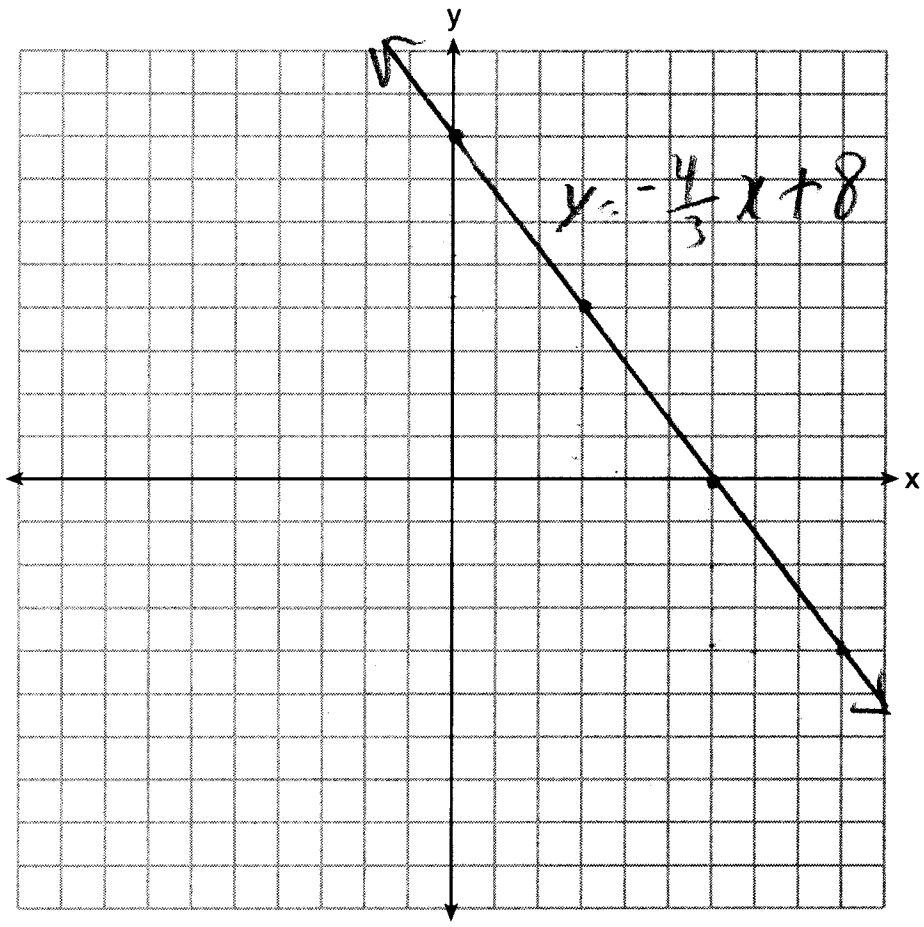
$\angle DAE \cong \angle CAB$ because they are same $\angle$

$\angle DEA \cong \angle CBA$ because they are both right $\angle$s.

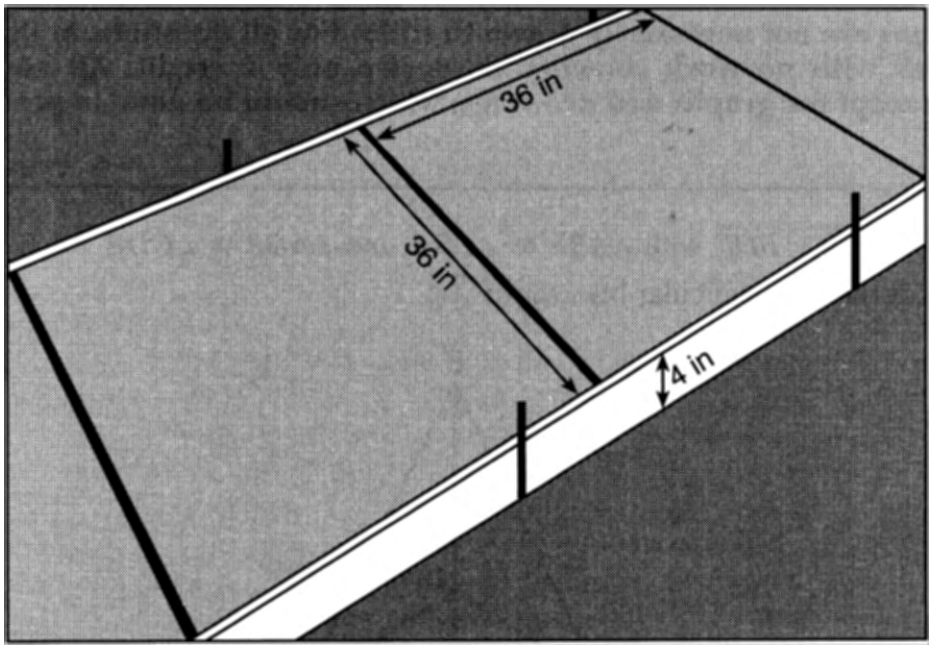
30 Aliyah says that when the line $4x + 3y = 24$ is dilated by a scale factor of 2 centered at the point (3,4), the equation of the dilated line is $y = -\frac{4}{3}x + 16$. Is Aliyah correct? Explain why.

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

No. Since the center of dilation is on the line, the equation remains the same



31 Ian needs to replace two concrete sections in his sidewalk, as modeled below. Each section is 36 inches by 36 inches and 4 inches deep. He can mix his own concrete for $3.25 per cubic foot.



How much money will it cost Ian to replace the two concrete sections?

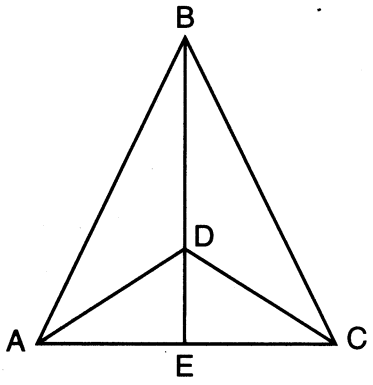
$2(3 \times 3 \times \frac{1}{3}) \cdot 3.25 = \$19.50$

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 Given: $\triangle ABC$, $\overline{AEC}$, $\overline{BDE}$ with $\angle ABE \cong \angle CBE$, and $\angle ADE \cong \angle CDE$

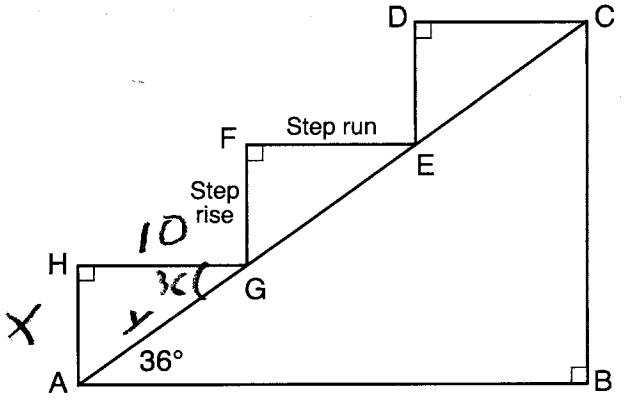
Prove: $\overline{BDE}$ is the perpendicular bisector of $\overline{AC}$



Fill in the missing statement and reasons below.

Statements	Reasons
(1) $\triangle ABC$, $\overline{AEC}$, $\overline{BDE}$ with $\angle ABE \cong \angle CBE$ and $\angle ADE \cong \angle CDE$	(1) Given
(2) $\overline{BD} \cong \overline{BD}$	(2) Reflexive
(3) $\angle BDA$ and $\angle ADE$ are supplementary. $\angle BDC$ and $\angle CDE$ are supplementary.	(3) Linear pairs of angles are supplementary.
(4) $\angle BDA \cong \angle BDC$	(4) Supplements of congruent angles are congruent.
(5) $\triangle ABD \cong \triangle CBD$	(5) ASA
(6) $\overline{AD} \cong \overline{CD}$, $\overline{AB} \cong \overline{CB}$	(6) CPCTC
(7) $\overline{BDE}$ is the perpendicular bisector of $\overline{AC}$.	(7) If points B & D are equidistant from the endpts. of $\overline{AC}$, then B & D are on the $\perp$ bisector of $\overline{AC}$,

33 A homeowner is building three steps leading to a deck, as modeled by the diagram below. All three step rises, $\overline{HA}$, $\overline{FG}$, and $\overline{DE}$, are congruent, and all three step runs, $\overline{HG}$, $\overline{FE}$, and $\overline{DC}$, are congruent. Each step rise is perpendicular to the step run it joins. The measure of $\angle CAB = 36°$ and $m\angle CBA = 90°$.



If each step run is parallel to $\overline{AB}$ and has a length of 10 inches, determine and state the length of each step rise, to the *nearest tenth of an inch*.

$\tan 36 = \frac{x}{10}$

$x \approx 7.3$

Determine and state the length of $\overline{AC}$, to the *nearest inch*.

$\cos 36 = \frac{10}{y}$

$y \approx 12.3607 \approx 37$

34 A bakery sells hollow chocolate spheres. The larger diameter of each sphere is 4 cm. The thickness of the chocolate of each sphere is 0.5 cm. Determine and state, to the *nearest tenth of a cubic centimeter*, the amount of chocolate in each hollow sphere.

$\frac{4}{3}\pi(2^3 - 1.5^3) \approx 19.4$

The bakery packages 8 of them into a box. If the density of the chocolate is 1.308 g/cm^3, determine and state, to the *nearest gram*, the total mass of the chocolate in the box.

$19.4 \cdot 1.308 \cdot 8 \approx 203$

GO RIGHT ON TO THE NEXT PAGE ➡

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 The vertices of quadrilateral *MATH* have coordinates $M(-4,2)$, $A(-1,-3)$, $T(9,3)$, and $H(6,8)$.

Prove that quadrilateral *MATH* is a parallelogram.

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

$m_{\overline{MH}} = \frac{6}{10} = \frac{3}{5}$ $\quad m_{\overline{MA}} = \frac{-5}{3}$

$m_{\overline{AT}} = \frac{6}{10} = \frac{3}{5}$ $\quad m_{\overline{HT}} = \frac{-5}{3}$

$\overline{MH} \parallel \overline{AT}$ $\quad \overline{MA} \parallel \overline{HT}$

MATH is a parallelogram since both pairs of opposite sides are ||.

Question 35 is continued on the next page.

Question 35 continued

Prove that quadrilateral *MATH* is a rectangle.

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

$m_{\overline{MA}} = \frac{-5}{3}$

$m_{\overline{AT}} = \frac{3}{5}$

Since the slopes are negative reciprocals, $\overline{MA} \perp \overline{AT}$ & $\angle A$ is a right $\angle$.

MATH is a rectangle because it is a parallelogram with a right $\angle$.