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

MODEL RESPONSE SET

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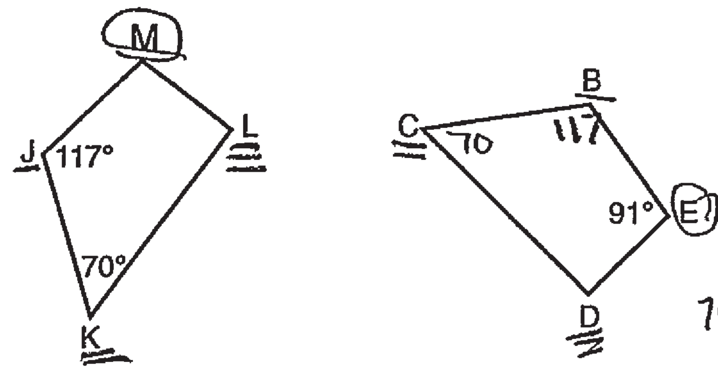
Question 25

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



$70+117+91=278$

$$\begin{array}{r} 360 \\ -\ 278 \\ \hline 82 \end{array}$$

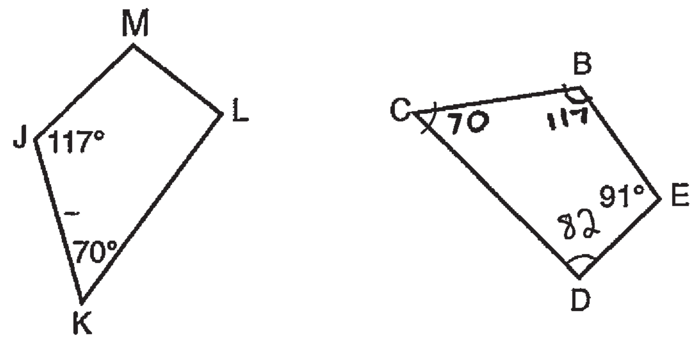
Determine and state the degree measure of angle *D*.

$\measuredangle D$ is 82° because all quadrilateral $\measuredangle$s add up to 360.

Score 2: The student gave a complete and correct response.

Question 25

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

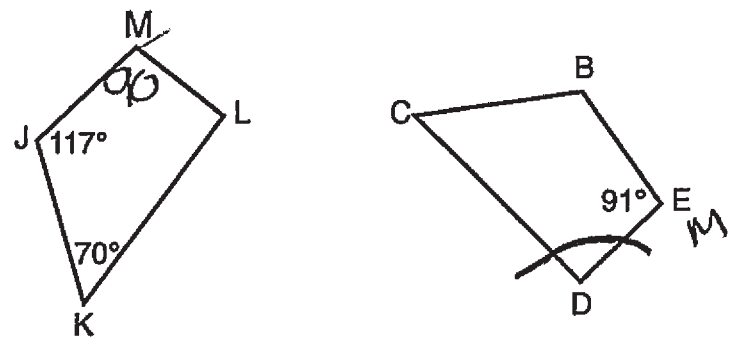


Determine and state the degree measure of angle *D*.

$\boxed{m\angle D = 82}$

Score 2: The student gave a complete and correct response.

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



Determine and state the degree measure of angle *D*.

m∠D is

$90 + 117 + 70 + x = 360$

$277 + x = 360$

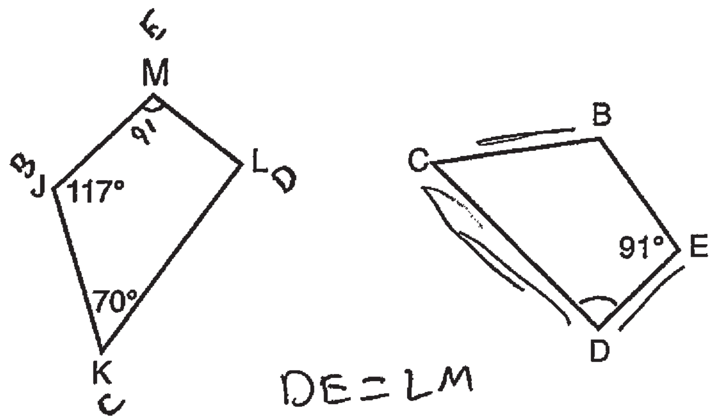
$-277 \quad -277$

$x = 83$

Score 1: The student made a transcription error stating m∠*M* = 90°.

Question 25

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



DE = LM

CD = LK

BC = JK

BE = JM

Determine and state the degree measure of angle *D*.

$117 + 70 + 91 + x = 360$

$298 + x = 360$

-298

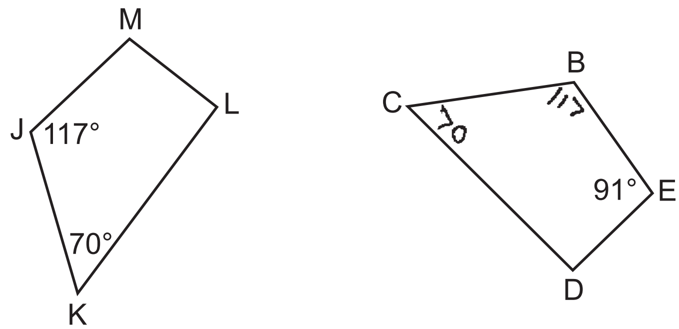
$x = 62°$

$\angle D = 62°$

Score 1: The student made a computational error.

Question 25

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



Determine and state the degree measure of angle *D*.

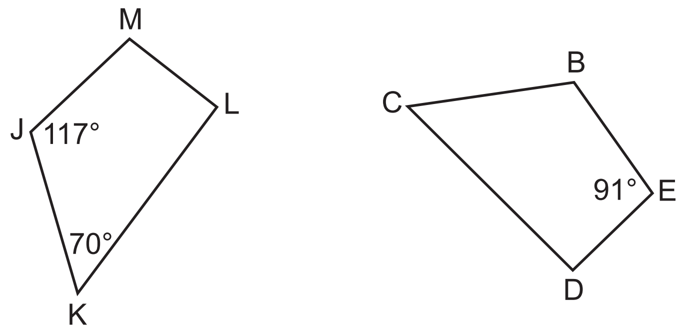
$70+117+91=278$

$360-278=98°$

Score 1: The student made a computational error.

Question 25

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



Determine and state the degree measure of angle *D*.

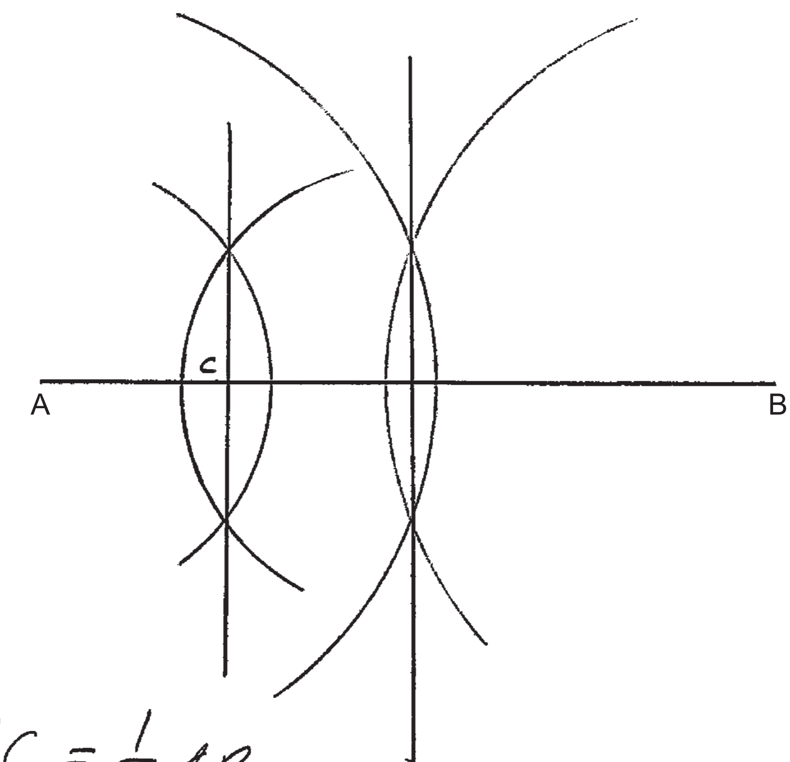
$117 + 70 + 91 = 278$

$\angle D = 278°$

Score 0: The student did not show enough relevant course-level work to receive any credit.

Question 26

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.]

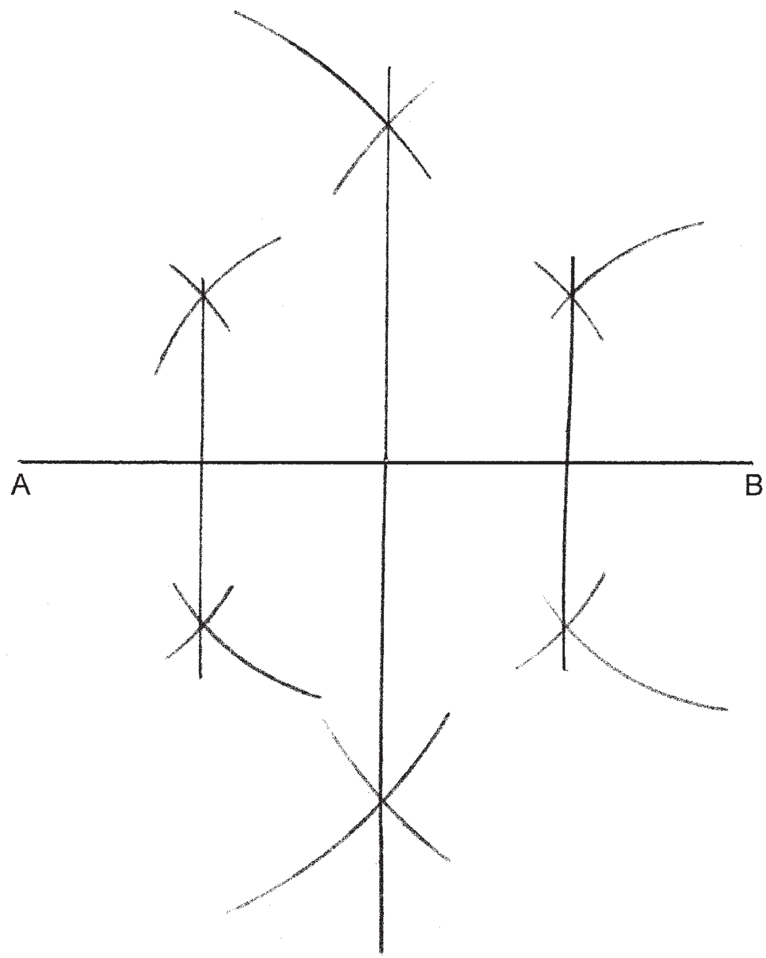


$AC = \frac{1}{4}AB$

Score 2: The student gave a complete and correct response.

Question 26

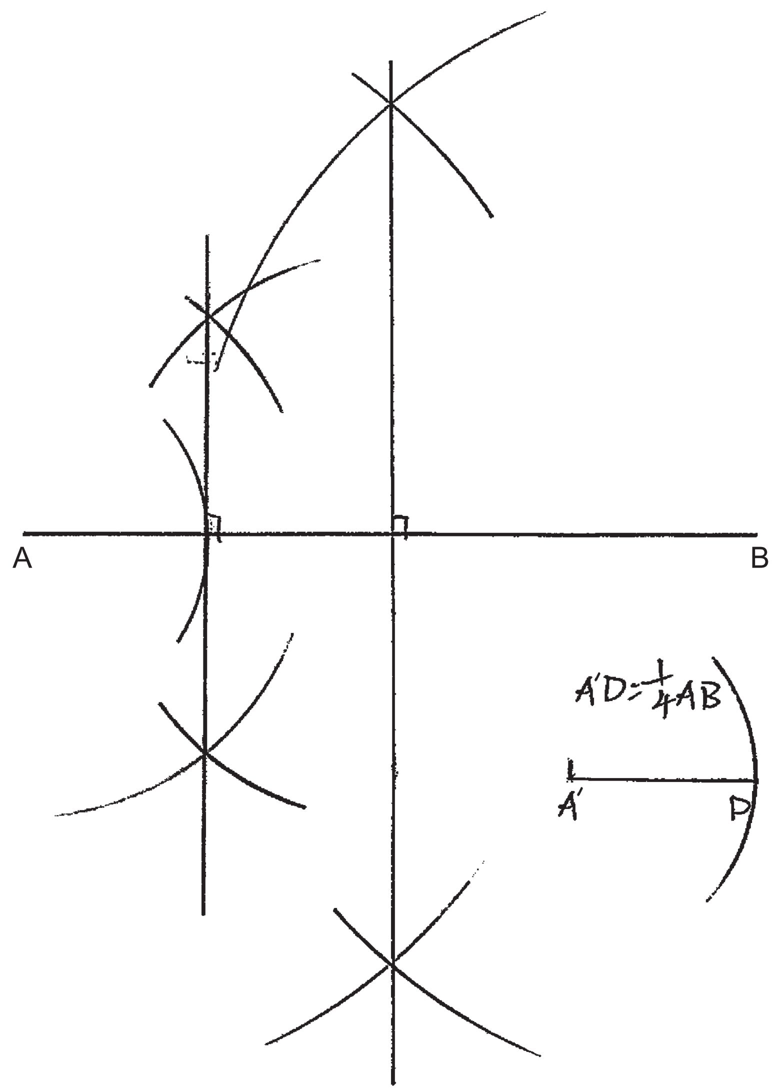
26 Given $\overline{AB}$ below, use a compass and a straightedge to construct a segment that is $\frac{1}{4}AB$. [Leave all construction marks.]



Score 2: The student gave a complete and correct response.

Question 26

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.]



Score 2: The student gave a complete and correct response.

Question 26

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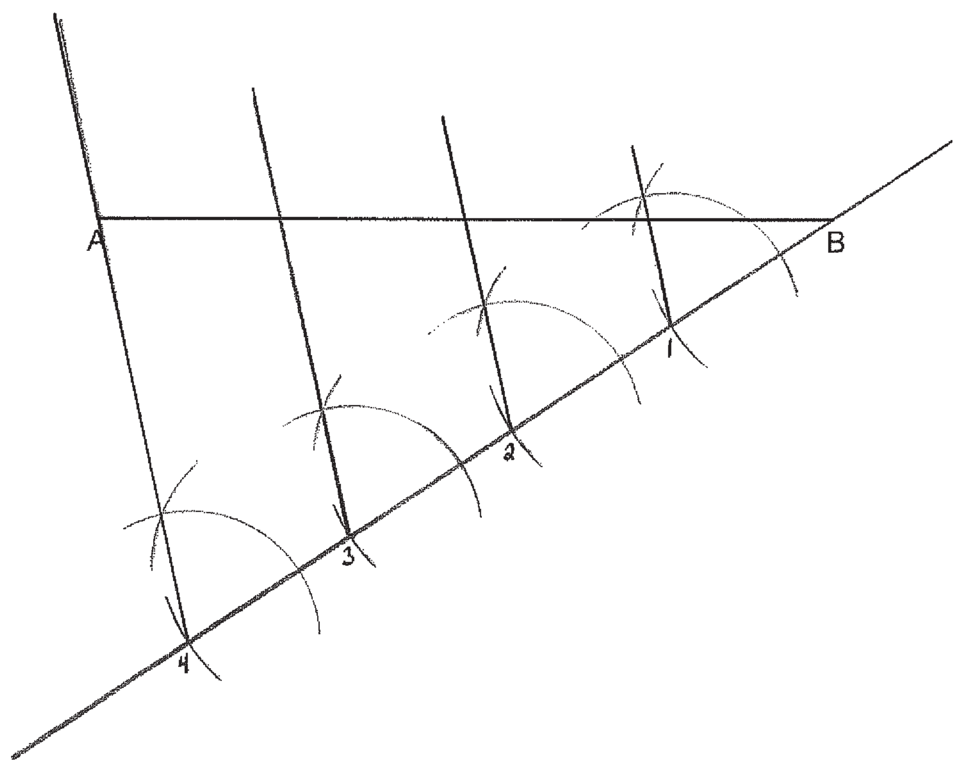
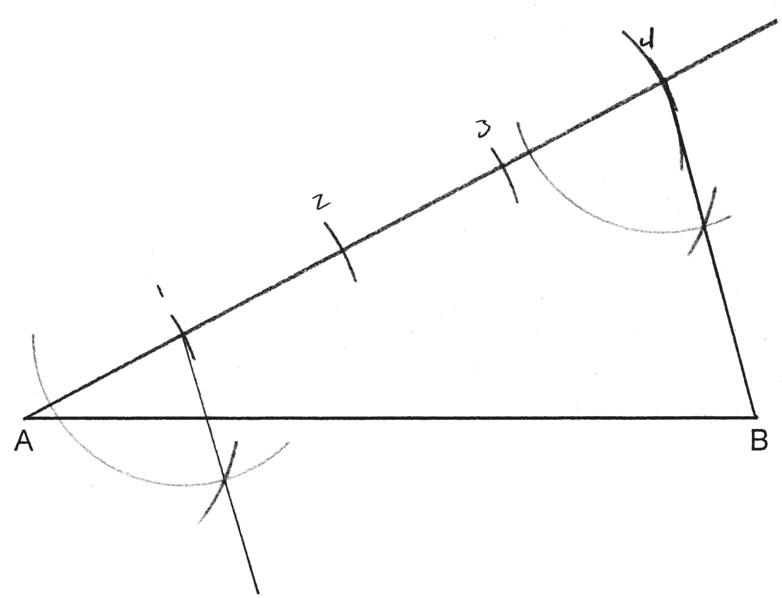


Score 2: The student gave a complete and correct response.

Question 26

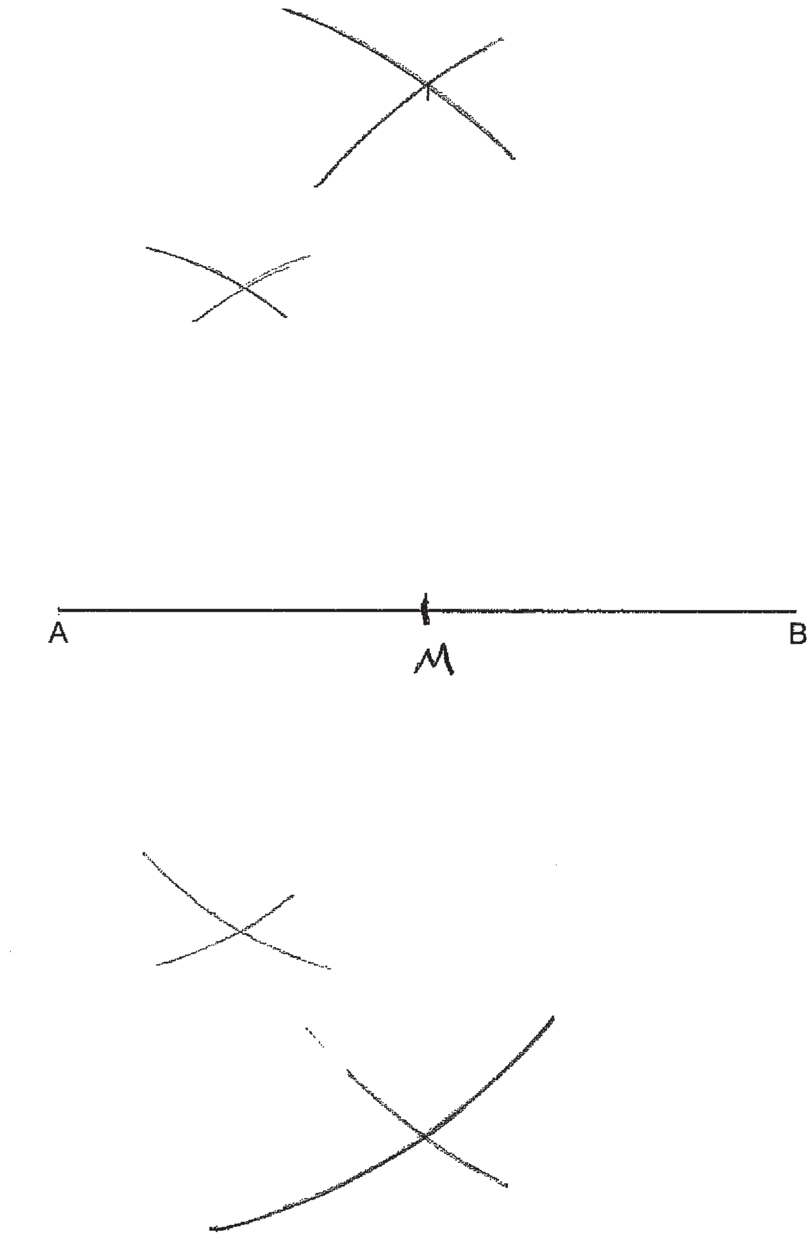
26 Given $\overline{AB}$ below, use a compass and a straightedge to construct a segment that is $\frac{1}{4}AB$. [Leave all construction marks.]



Score 2: The student gave a complete and correct response.

Question 26

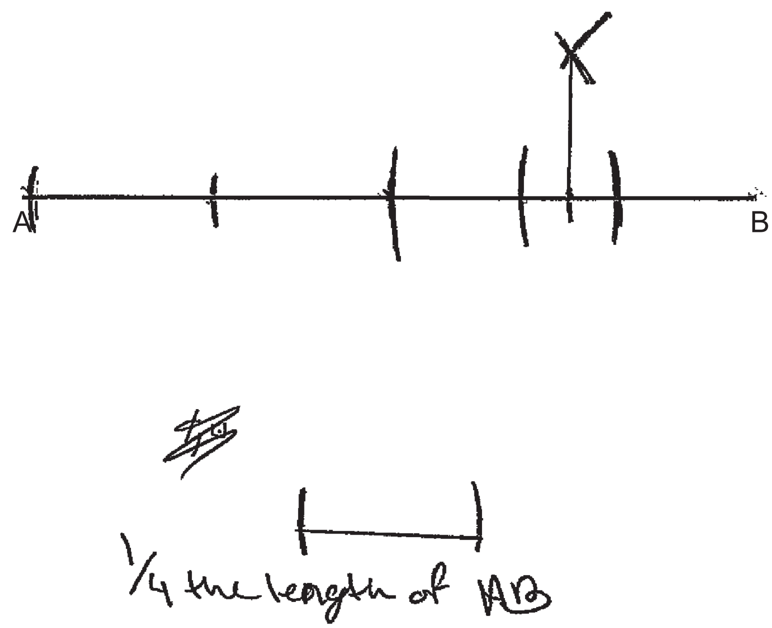
26 Given $\overline{AB}$ below, use a compass and a straightedge to construct a segment that is $\frac{1}{4}AB$. [Leave all construction marks.]



Score 1: The student constructed all appropriate arcs, but did not determine the midpoint of $\overline{AM}$.

Question 26

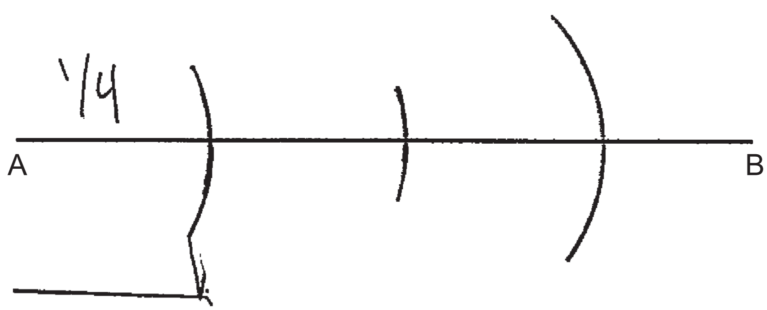
26 Given $\overline{AB}$ below, use a compass and a straightedge to construct a segment that is $\frac{1}{4}AB$. [Leave all construction marks.]



Score 0: The student did not show enough correct work to receive any credit.

Question 26

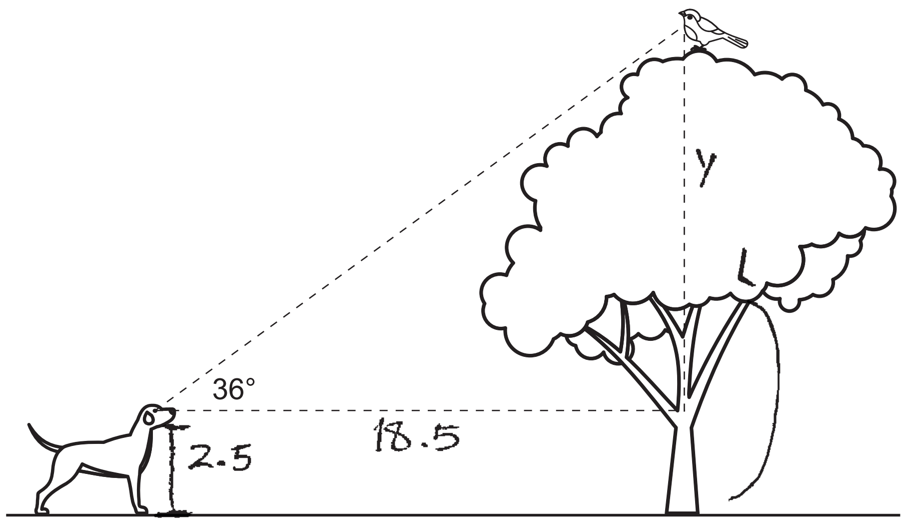
26 Given $\overline{AB}$ below, use a compass and a straightedge to construct a segment that is $\frac{1}{4}AB$. [Leave all construction marks.]



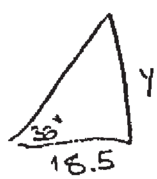
Score 0: The student did not show enough correct work to receive any credit.

Question 27

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



toa

$\tan 36 = \frac{y}{18.5} \cdot \times 18.5$

$18.5 \tan 36 = y$

$13.44103677 = y$

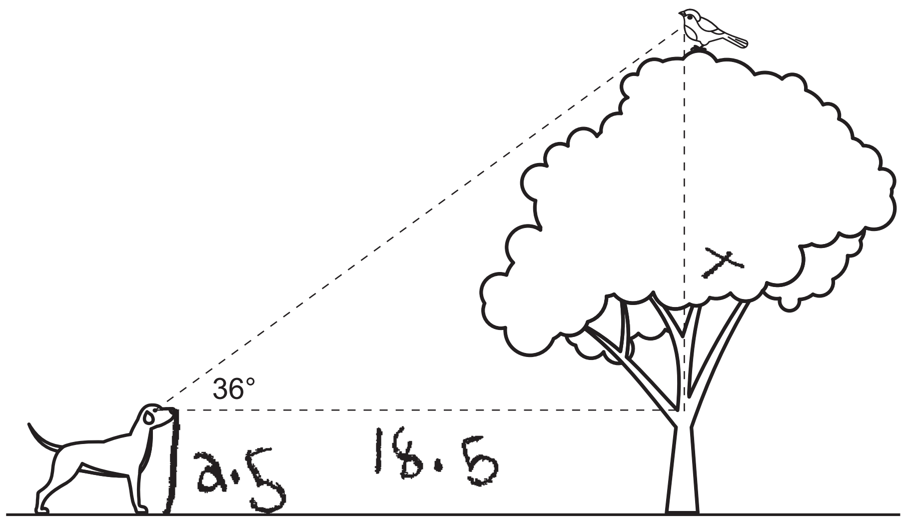
$+ \ 2.5$

$= 16 \text{ ft}$

Score 2: The student gave a complete and correct response.

Question 27

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

$$\begin{array}{r} 13.4 \\ +\ 2.5 \\ \hline 15.9 \end{array}$$

opp adj

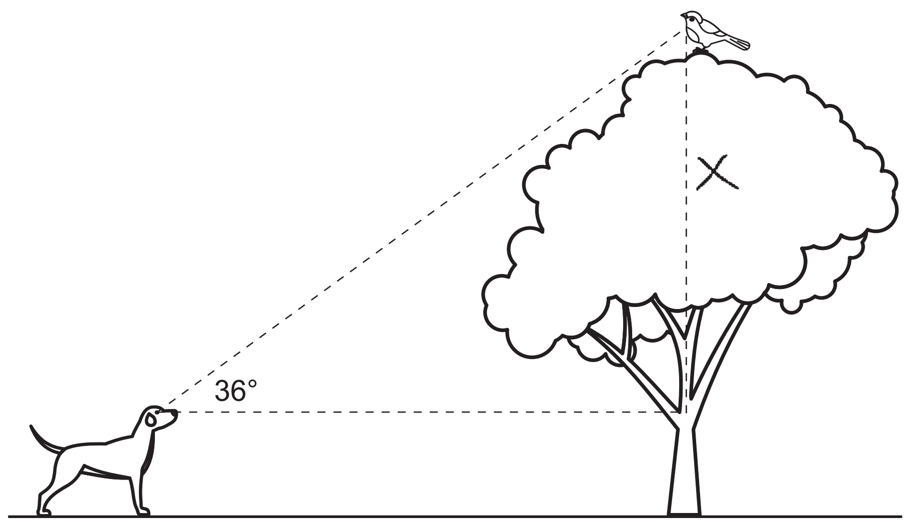
18.5Tan (36)

16 ft

Score 2: The student gave a complete and correct response.

Question 27

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.



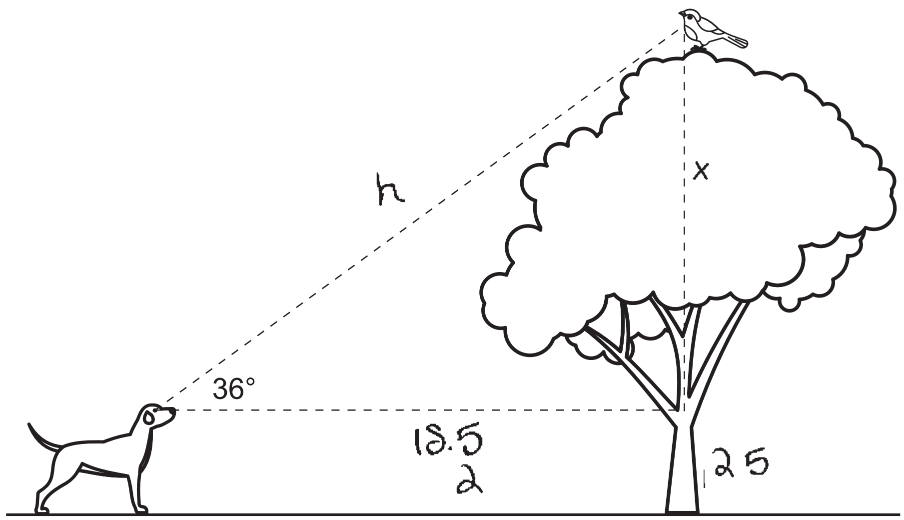
The dog is 18.5 feet away from the base of the tree, and his eyes are 2.5 feet above the ground. Determine and state how high the bird is above the ground, to the *nearest foot*.

$$\tan(36^\circ) = \frac{x}{18.5}$$

Score 1: The student wrote a correct relevant trigonometric equation.

Question 27

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

$\tan(36) = \frac{x}{18.5}$

$0.726542528 = \frac{x}{18.5}$

$18.5 \quad \cdot 18.5$

13.441036777

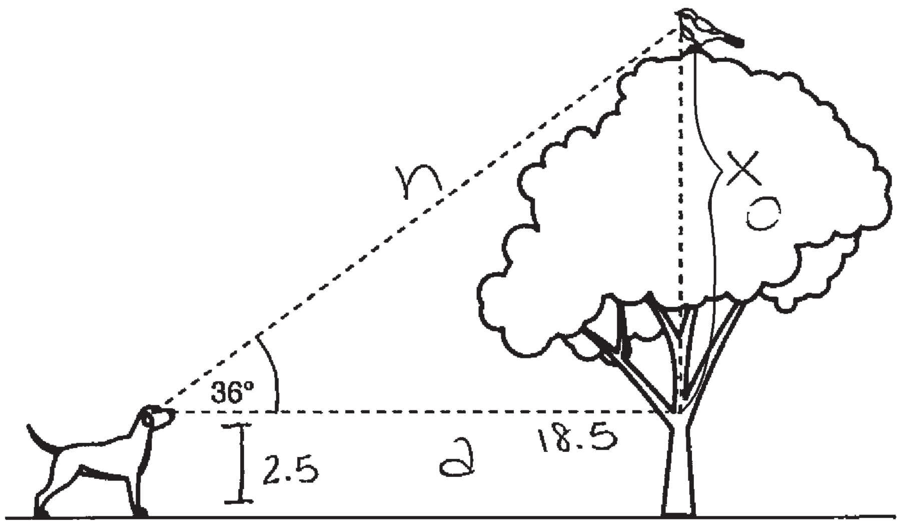
$+ 2.5$

15.9ft

Score 1: The student made a rounding error.

Question 27

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.



S $\frac{O}{H}$ C $\frac{A}{H}$ T $\frac{O}{A}$

The dog is 18.5 feet away from the base of the tree, and his eyes are 2.5 feet above the ground. Determine and state how high the bird is above the ground, to the *nearest foot*.

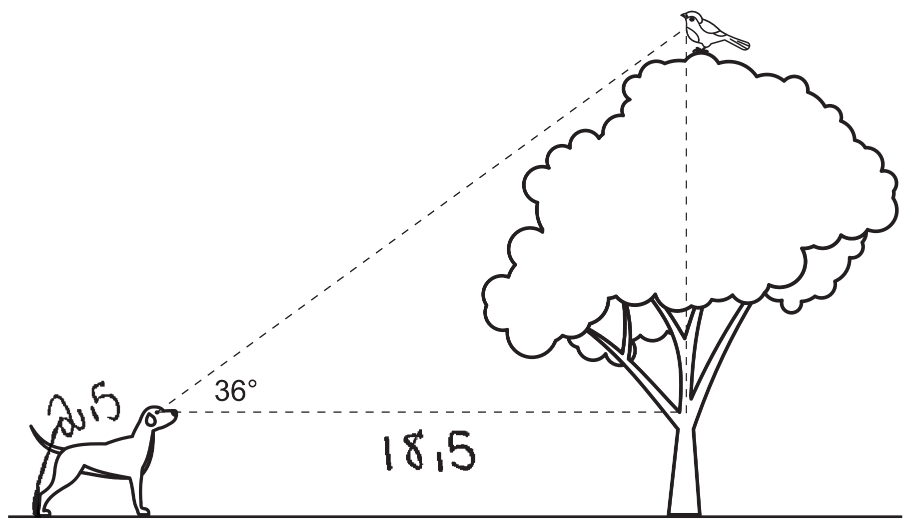
$$\frac{\tan(36)}{1} = \frac{x}{18.5}$$

$$\boxed{x = 13 \text{ feet}}$$

Score 1: The student did not add 2.5 when determining the height.

Question 27

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

SOH CAH TOA

$36 = \cos(18.5)(x)$

$36 = .95(x)$

$\frac{36}{.95} = \frac{.95x}{.95}$

$x = 37.89$

37.89
2.5
40.39 → 40

40 feet

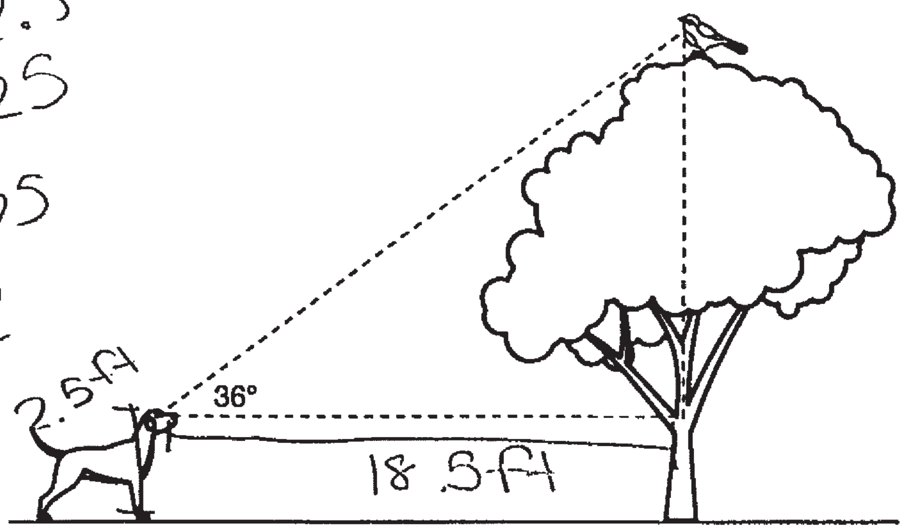
Score 0: The student did not show enough correct relevant course-level work to receive any credit.

Question 27

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.

18.5×2.5
$= 46.25$

$90 - 46.25$
$= 43.72$



The dog is 18.5 feet away from the base of the tree, and his eyes are 2.5 feet above the ground. Determine and state how high the bird is above the ground, to the *nearest foot*.

The bird is 44 feet high above the ground

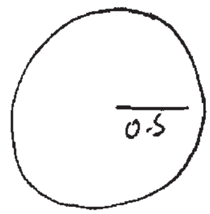
Score 0: The student did not show enough relevant course-level work to receive any credit.

Question 28

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*.

$\text{Density} = \frac{m}{V}$



$V = \frac{4}{3}\pi r^3$

$\frac{4}{3} \cdot \pi \cdot (0.5)^3$

$\frac{4}{3} \cdot 0.125\pi$

0.523

$10.5 = \frac{m}{0.523}$

$\times 0.523 \quad \times 0.523$

$5.49779 = m$

$\approx$

$\boxed{5.5}$

Score 2: The student gave a complete and correct response.

Question 28

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*.

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}(0.5)^3 \pi$

$10.5 = \frac{m}{.5235987757}$

$m = 5.497787145$

$\boxed{m = 5.5}$

Score 2: The student gave a complete and correct response.

Question 28

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*.

$d = 10.5\ g/cm^3$

$M = \boxed{}$

$\boxed{V = 0.523599}$

radis = 0.5cm

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi(.5)^3$

$V = 0.523599$

$\cancel{d = \frac{m}{V}}$

$\cancel{10.5 = \frac{5.5}{0.523599}}$

$d = \frac{m}{V}$

$m = d \div V$

$m = 10.5 / 0.523599$

$m = 20.0535$

$\cancel{m = d \cdot V}$

$\cancel{m = 10.5 \cdot 0.523599}$

$\cancel{m = 5.49779}$

$m = 20.1$

$\cancel{m = 5.5}$

20.1g is the mass of the charm.

Score 1: The student made an error when determining the mass by dividing instead of multiplying.

Question 28

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*.

$A = \pi r^2$

$A = \pi(0.5)^2$

$A = .25\pi$

$A = .785$

$m = 10.5(.785)$

$\boxed{m = 8.2 \text{ grams}}$

Score 1: The student made an error when determining the volume, but found an appropriate mass.

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*.

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3} \cdot \pi \cdot 0.5^3$

$V = 0.5235987756 \ \cancel{cm^3}$

$\times \quad 10.5 \ g/\cancel{cm^3}$

$5.497787144 \ g$

$D = \frac{M}{V}$

$5.497787 = \frac{M}{0.523598}$

$M \approx 2.9 \ g$

$\boxed{\text{The mass of the charm is about 2.9 grams.}}$

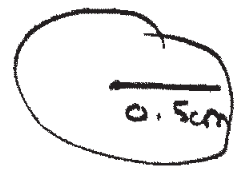
Score 1: The student correctly determined the volume, but made an error when determining the mass.

Question 28

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*.

$10.5\text{g}/\text{cm}^3$



$V = \frac{4}{3}\pi r^3$

$\frac{4}{3}\, 3.14\, (0.5)^3$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

Question 28

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*.

$\cancel{\pi r^2}$

$\cancel{2.4674 \cdot 10.5}$

$\frac{4}{3}\pi r^3$

$9.18 \cdot 10.5$

96.4g

Score 0: The student did not show enough relevant course-level work to receive any credit.

Question 28

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*.

$D = \frac{m}{V}$

$10.5 = \frac{m}{0.5}$

$10.5 \cdot 0.5 = 5.25$

$m = 5.25$

Check:

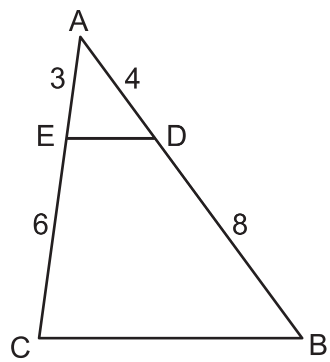
$\frac{5.25}{0.5} = 10.5$

Score 0: The student did not show enough relevant course-level work to receive any credit.

Question 29

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

$3/6 = \frac{1}{2}$



$4/8$

$1/2$

$\frac{AE}{EC} = \frac{AD}{DB}$

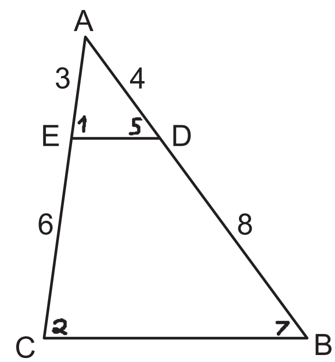
Explain why $\triangle ADE \sim \triangle ABC$.

$\overline{DE}$ cuts the left and right proportionaly which results in $\overline{ED} \parallel \overline{CB}$ the corresponding angles of $\triangle ADE$ and $\triangle ABC$ are $\cong$ ($\angle AED \cong \angle ACB$ and $\angle ADE \cong \angle ABC$), making them $\sim$ by AA$\sim$

Score 2: The student gave a complete and correct response.

Question 29

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



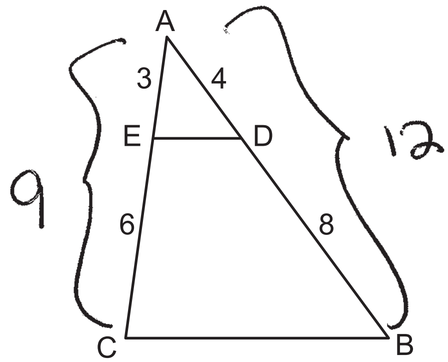
Explain why $\triangle ADE \sim \triangle ABC$.

Its a dilation with Scale factor = 3 centered at A and dilations preserve angle measure so $\angle 1 \cong \angle 2$ and $\angle 5 \cong \angle 7$. By AA~, $\triangle ADE \sim \triangle ABC$.

Score 2: The student gave a complete and correct response.

Question 29

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



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

$\measuredangle A \cong \measuredangle A$ and the ratio of the sides is the same making the sides proportional $\frac{AE}{AC} = \frac{AD}{AB}$, $\frac{3}{9} = \frac{4}{12}$

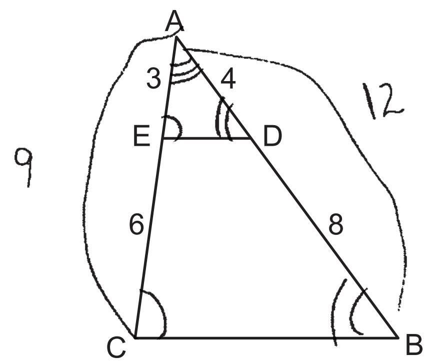
$36 = 36$

$\triangle ADE \sim \triangle ABC$ by SAS similarity.

Score 2: The student gave a complete and correct response.

Question 29

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



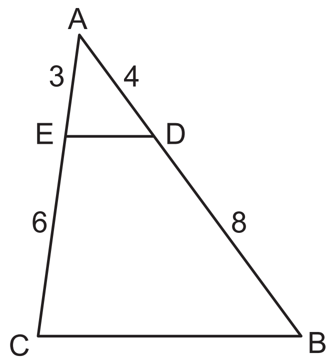
Explain why $\triangle ADE \sim \triangle ABC$.

ΔADE is a $\frac{1}{3}$ dilation of ΔABC centered at A
so $\Delta ADE \sim \Delta ABC$

Score 1: The student wrote an incomplete explanation.

Question 29

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



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

$$\frac{3}{6} = \frac{4}{8}$$

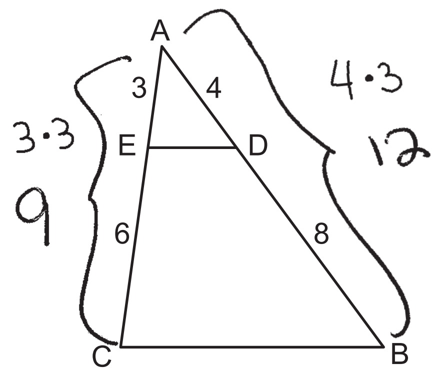
$$\frac{1}{2} = \frac{1}{2} \checkmark$$

They are ~ because the sides are divided proportionally

Score 1: The student wrote an incomplete explanation.

Question 29

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

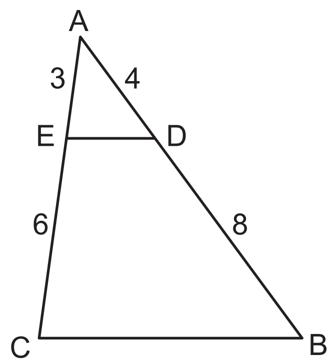


Explain why $\triangle ADE \sim \triangle ABC$.

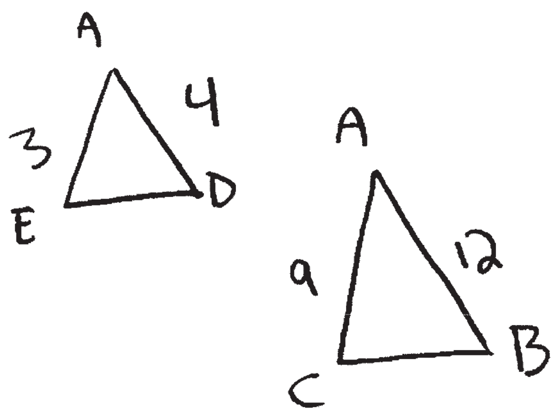
ΔADE and ΔABC are similar because the ratio of 3:4 and 9:12 are the same.

Score 1: The student wrote an incomplete explanation.

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



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



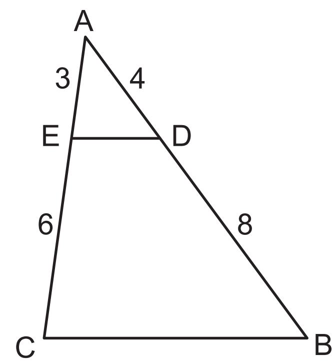
$$\frac{9}{3} = \frac{12}{4}$$

$27 = 36 \quad 27 \sim 36$

Score 0: The student wrote a correct proportion, but no further correct work is shown.

Question 29

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

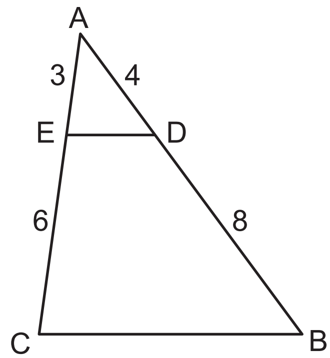


Explain why $\triangle ADE \sim \triangle ABC$.

Because the side lengths are proportional

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

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



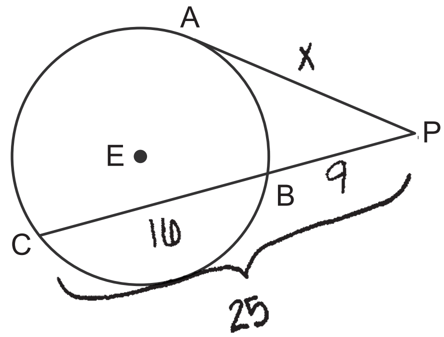
Explain why $\triangle ADE \sim \triangle ABC$.

$\triangle ADE$ is $\sim \triangle ABC$ because $\triangle ADE$ is just a dilation of $\frac{1}{2}\triangle ABC$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

Question 30

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



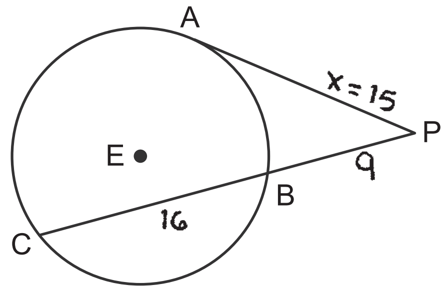
If $PB = 9$ and $BC = 16$, determine and state the length of $\overline{PA}$.

$$x^2 = (25)(9)$$
$$\sqrt{x^2} = \sqrt{225}$$
$$x = 15$$

Score 2: The student gave a complete and correct response.

Question 30

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 $\overline{PA}$.

$x^2 = 9(9+16)$

$x^2 = 81 + 144$

$x^2 = 225$

$x = \sqrt{225}$

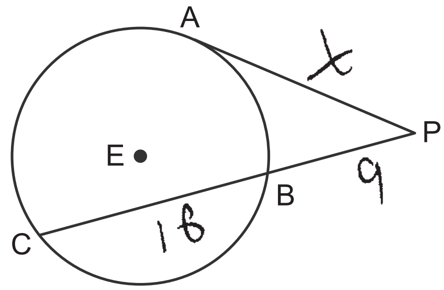
$= 15$

$\boxed{PA = 15}$

Score 2: The student gave a complete and correct response.

Question 30

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 $\overline{PA}$.

$(16+9)(9) = (x)(x)$

$\sqrt{225} = \sqrt{x^2}$

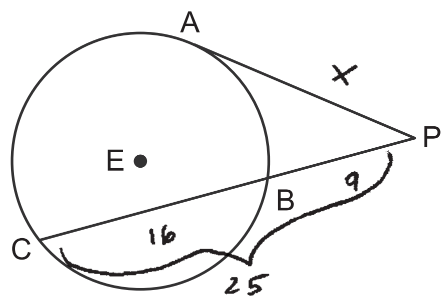
$15 = x$

$\boxed{x = 15}$

Score 2: The student gave a complete and correct response.

Question 30

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 $\overline{PA}$.

$16 + 9 = 25$

$x^2 = 16 \cdot 9$

$\sqrt{x^2} = \sqrt{144}$

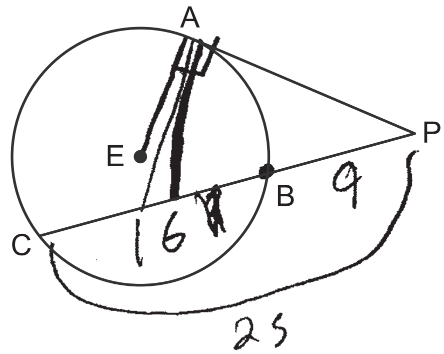
$\boxed{x = 12}$

$\boxed{PA = 12}$

Score 1: The student made an error in not using the length of the entire secant.

Question 30

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



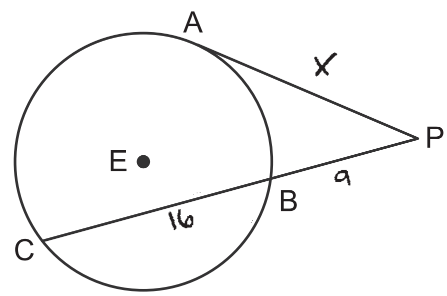
If $PB = 9$ and $BC = 16$, determine and state the length of $\overline{PA}$.

PA = 15

Score 1: The student wrote a correct answer, but did not show work.

Question 30

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 $\overline{PA}$.

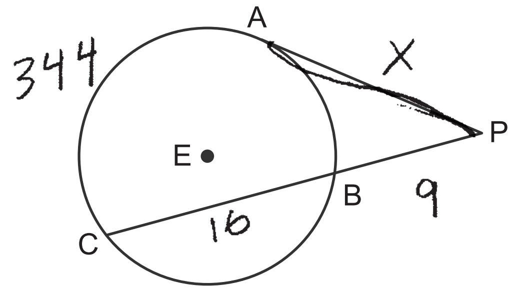
$16+9=25$

$\frac{25}{2}=12.5$

$\boxed{12.5}$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

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 $\overline{PA}$.

$360 - 16 = 344$

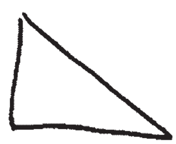
$\overline{PA} = 1/2(344 - 9)$

$\boxed{\overline{PA} = 167.5}$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

Question 31

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



$(4x+3)+(2x-9)=90$

$6x-6=90$

$+6 \quad +6$

$\frac{6x=96}{6}$

$\boxed{x=16}$

$\sin(4x+3)=\cos(2x-9)$ ✓

$\sin(4(16)+3)=\cos(2(16)-9)$

$\sin(64+3)=\cos(32-9)$

$\sin(67) = \cos(23)$

$0.92 = 0.92$

Score 2: The student gave a complete and correct response.

Question 31

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

$$4x+3+2x-9=90$$

$$6x-6=90$$

$$+6 \quad +6$$

$$\frac{6x}{6}=\frac{96}{6}$$

$$x=16$$

Score 2: The student gave a complete and correct response.

Question 31

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

$$4x + 3 + 2x - 9 = 90°$$
$$6x + 6 = 90°$$
$$-6 \quad -6$$
$$\frac{6x}{6} = \frac{84}{6}$$
$$\boxed{x = 14}$$

Score 1: The student made a computational error.

Question 31

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

$4x+3 = 90-(2x-9)$

$4x+3 = 90-2x+9$

$4x+3 = 99-2x$

$6x = 102$

$x = 17$

Score 1: The student made a computational error.

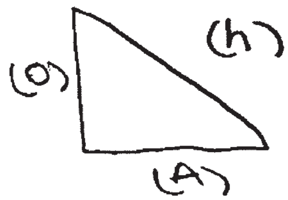
Question 31

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

$$4x+3=2x-9$$
$$-2x \qquad -2x$$
$$2x+3=-9$$
$$-3 \qquad -3$$
$$\frac{2x}{2}=\frac{-12}{2}$$
$$x=-6$$

Score 1: The student made a conceptual error by applying the cofunction relationship incorrectly, but solved their equation appropriately.

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



$\sin(4x+3) = 90$

$\quad -3 \quad -3$

$\cancel{\sin \; 4x = 87}$

$\quad 1 \quad 3$

$\cancel{\sin 3 = 4x}$

$\quad 4 \quad 4$

$\cancel{x = .01308}$

$x = 673.1251$

$\boxed{x = 673}$

$\sin 48 = 87$

$\sin 4x \quad \sin 4$

$x = 1247.19$

$\cos(2x-9) = 90$

$\quad +9 \quad +9$

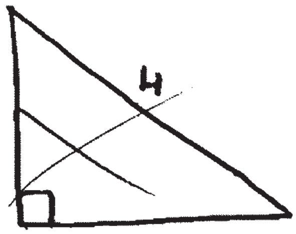
$\cos 2x = 99$

$\cos 2 \quad \cos 2$

$x = 99.0603$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

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



$$4x + 3 = 2x - 9$$
$$6x + 3 = -9$$
$$-3 \quad -3$$
$$\frac{6x}{6} = \frac{12}{6}$$
$$x = 2$$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

Question 32

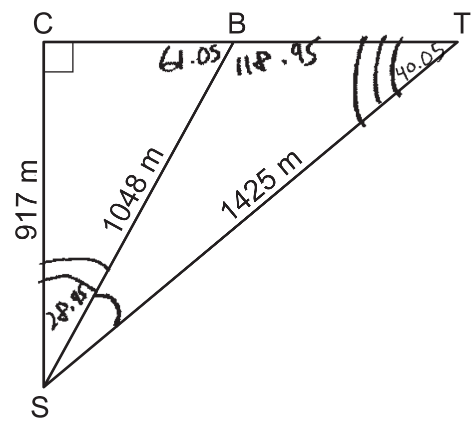
32 Modeled by right triangles below, a surveyor (S) is taking land measurements using a cabin (C), a boulder (B), and a tree (T) as fixed points of reference. The cabin, boulder, and tree are collinear.

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

$m\angle BSC = \cos^{-1}\left(\frac{917}{1048}\right) = 28.95$

$90 + 28.95 = 118.95$

$m\angle SBC = 180 - 118.95 = 61.05$



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

$m\angle T \ \sin^{-1}\left(\frac{917}{1425}\right) = 40.05$

$118.95 + 40.05 = 159$

$180 - 159 = 21$

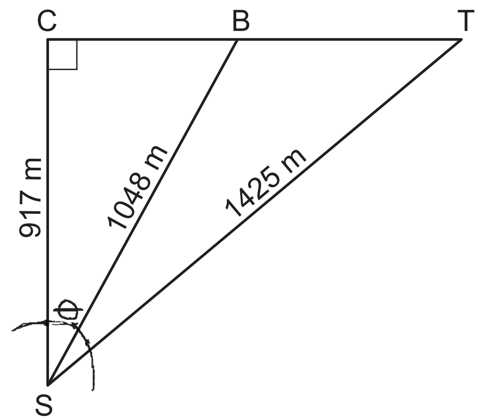
$m\angle BST = 21°$

Score 4: The student gave a complete and correct response.

Question 32

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.



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

$C \frac{a}{h} = \frac{917}{1425}$

$49.946 = \angle CST$

$\angle CSB: \cos Ø = \frac{917}{1048}$

$Ø = 28.955°$

$49.946° - 28.955° = 20.991°$

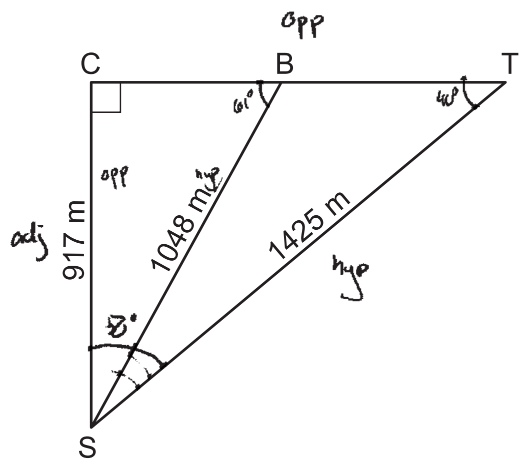
$\boxed{\angle BST = 21°}$

Score 4: The student gave a complete and correct response.

Question 32

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.



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

$\cos(CST) = \frac{917}{1425}$

$\frac{917}{1425} = \frac{1425(\cos(CST))}{1425}$

$0.6435087719 = \cos(CST)$

$m\angle CST = 49.946$

$90 + 49.946 = 139.946$

$180 - 139.946 = 40.054$

$\sin(SBC) = \frac{917}{1048}$

$\frac{917}{1048} = \frac{1048(\sin(SBC))}{1048}$

$0.875 = \sin(SBC)$

$m\angle(SBC) = 61.045$

$90 + 61.045 = 151.045$

$180 - 151.045 = 28.995$

$49.946 - 28.995 = 20.991$

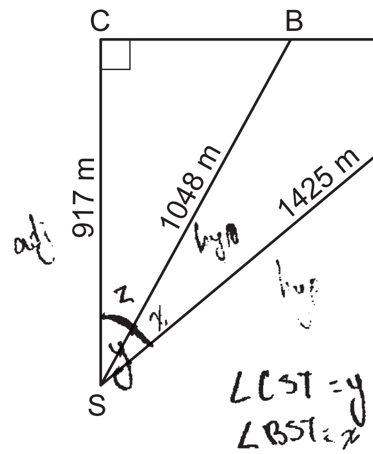
$\boxed{\angle BST = 21^\circ}$

Score 4: The student gave a complete and correct response.

Question 32

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.



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

$\cos(y) = \frac{971}{1425}$

$y^\circ = \cos^{-1}\left(\frac{971}{1425}\right)$

$y = 47.04658424$

$z^\circ = \cos^{-1}\left(\frac{971}{1048}\right)$

$z^\circ = 22.10029138$

$y^\circ - z^\circ = x^\circ$

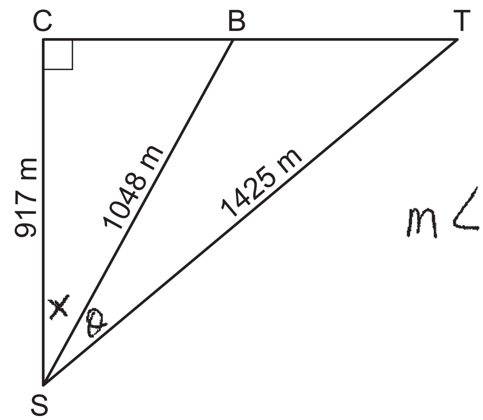
$\boxed{x^\circ = 25^\circ \quad \angle BST = 25^\circ}$

Score 3: The student made a transcription error using 971 instead of 917.

Question 32

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.



$m\angle S + m\angle T = 90$

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

$\sin T = \frac{917}{1425}$

$m\angle CSB$

$\cos x = \frac{917}{1048}$

$T = \sin^{-1}(917/1425)$

$x = \cos^{-1}(917/1048)$

$m\angle T = 40.0539\ldots$

$m\angle CSB = 28.955$

$\underbrace{41 \quad + \quad 29}$ $\rightarrow 70$

$\theta = 90 - (x + T)$

$= 90 - 70$

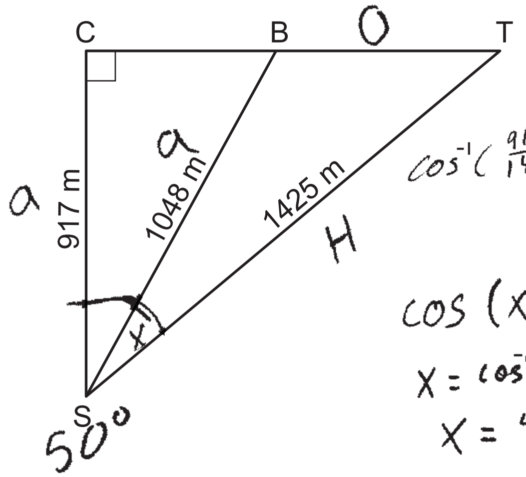
$\boxed{20}$

Score 3: The student made a rounding error when determining the measure of $\angle T$.

Question 32

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.



$\cos^{-1}\left(\frac{917}{1425}\right) = 49.9 > 50^\circ = m\angle CST$

$\cos(x) = \frac{1048}{1425}$

$x = \cos^{-1}\left(\frac{1048}{1425}\right)$

$x = 43^\circ$

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

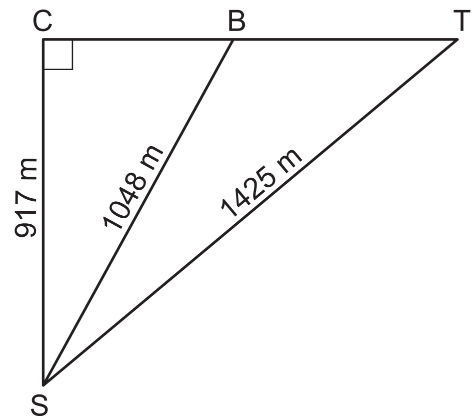
$\boxed{m\angle BST = 23^\circ}$

Score 2: The student correctly determined the measure of $\angle CST$.

Question 32

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.



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

$m\angle CST = \cos(x) = \frac{917}{1425}$

$\cos^{-1}\left(\frac{917}{1425}\right) = 49.9° = 50°$

$50 \div 2 = 25$

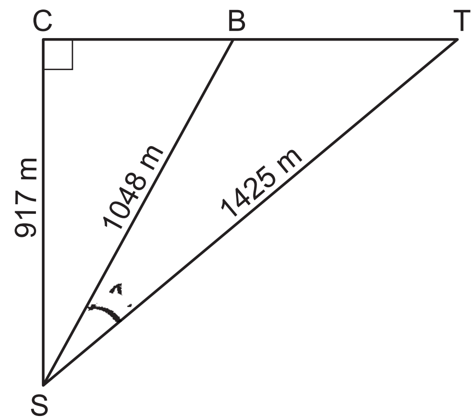
$\boxed{m\angle BST = 25°}$

Score 2: The student correctly determined the measure of $\angle CST$.

Question 32

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.



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

$$\cos^{-1}(1048/1425) = 42.6557100\text{6}$$

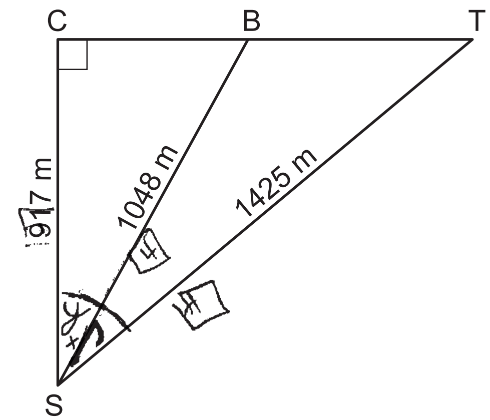
$$\angle BST = 42.65571006$$

Score 1: The student made a conceptual error in using right triangle trigonometry in a non-right triangle. The student made a rounding error.

Question 32

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.



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

$\boxed{132^{\circ}}$

$\cos x = \frac{917}{1425}$

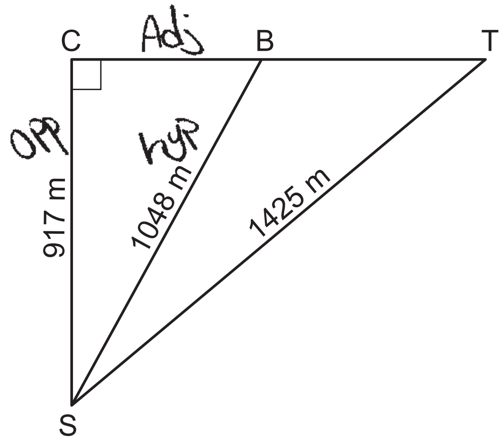
949

$\cos y = \frac{917}{1048}$

Score 1: The student wrote at least one correct relevant trigonometric equation.

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.



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

SOHCAHTOA

$\sin\left(\frac{917}{1048}\right) = .0152$

$1425(.0152) = 21.66$

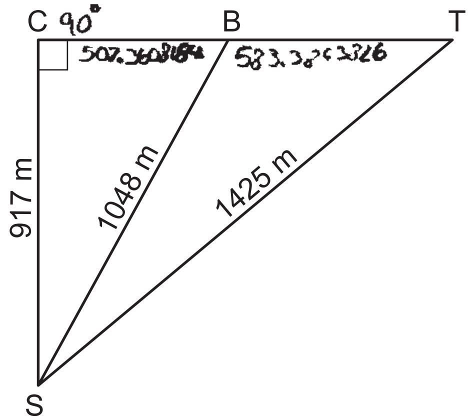
$BST = 22$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

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.

1090.75021m



$A^2+B^2=C^2$
$917^2+B^2=1425^2$
$840889+B^2 \; 2030625$
$B^2=\sqrt{1189736}$
$B=1090.750201$

$A^2+B^2=C^2$
$917^2+B^2=1048^2$
$840889+B^2=1098304$
$B^2=257415$

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

$\frac{Adj}{HYP}$

$\frac{Tan(s)}{1}=\frac{1048}{1425}$

$\frac{1425\ Tan(s)=1048}{1425\ Tan}$

$s=42.13324898$

$\angle BST=42.1°$

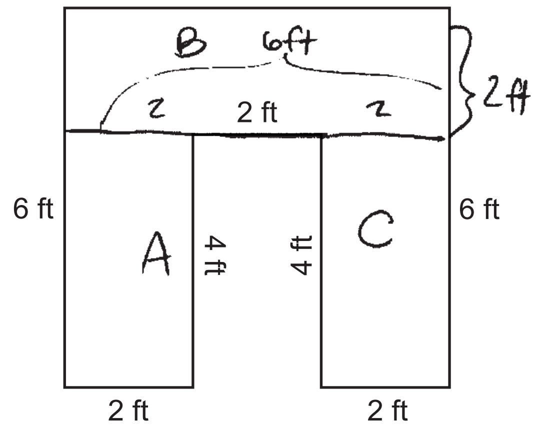
Score 0: The student did not show enough correct relevant course-level work to receive any credit.

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.

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

$V_A = (4)(2)(1.25) = 10\ ft^3$

$V_B = (6)(2)(1.25) = 15\ ft^3$

$V_C = (4)(2)(1.25) = 10\ ft^3$

total volume = $\boxed{35\ ft^3}$

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.

$35/2 = 17.5 \approx 18$ bags

$18 \cdot 3.68 = \boxed{\$66.24}$

Score 4: The student gave a complete and correct response.

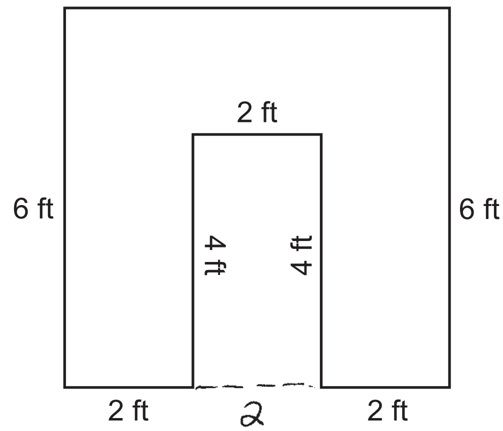
Question 33

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.

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

$6 \cdot 6 = 36$
$2 \cdot 4 = 8$

$V = Bh$
$V = (36)(1.25)$
$V = 45$

$v = Bh$
$v = (8)(1.25)$
$v = 10$

$V = 35 \text{ ft}^3$

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.

$\frac{35}{2} = 17.5$

$18 * 3.68$
66.24

\$66.24

18 bags

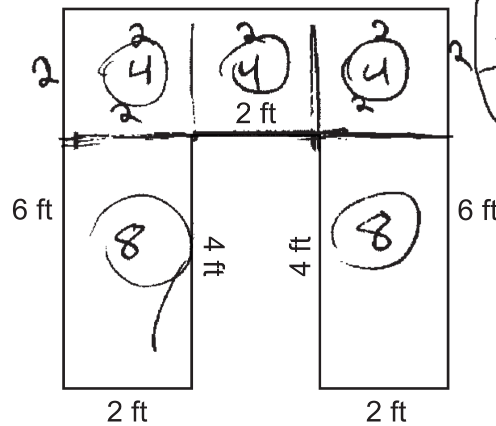
Score 4: The student gave a complete and correct response.

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



12
+16
28

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

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

28

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.

$\frac{28}{2} = 14$ $\quad 14(3.68)$ = \$51.52 for total cost of soil.

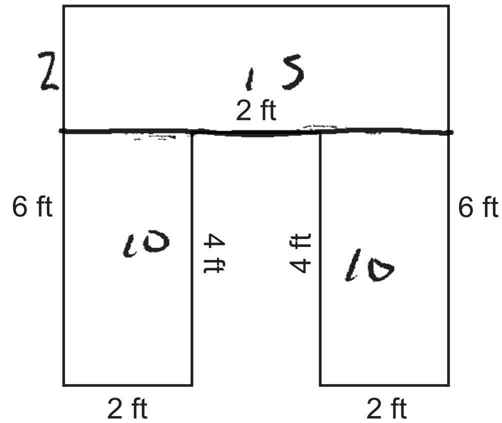
Score 3: The student correctly determined the area of the base of the garden bed and determined an appropriate cost.

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.

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

$V = \overset{(6\cdot6)}{B}h$

$V = (4\cdot2)(1.25)$

$V = 10$

$V = Bh$

$V = (6\cdot2)(1.25)$

$\cancel{V = 24}$

15

$10 + 10 + 15 = \boxed{35\ ft^3}$

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.

$\frac{35}{2} = 17.\cancel{5}$

$\boxed{\$62.56}$

$3.68 \cdot 17 = 62.56$

Score 3: The student made an error in using 17 bags to determine the cost.

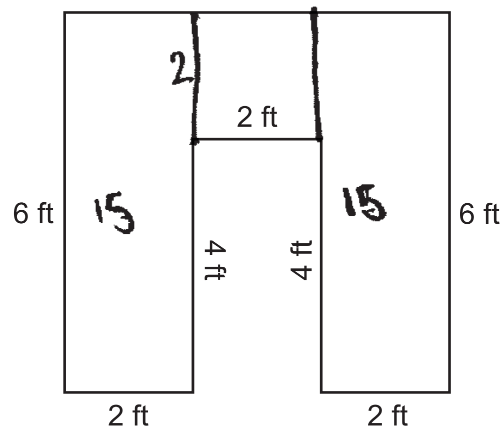
Question 33

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.

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

$6 \cdot 2 \cdot 1.25 = 12 \cdot 1.25 = 15 \text{ ft}^3$

$2 \cdot 2 \cdot 1.25 = 4 \cdot 1.25 = 5 \text{ ft}^3$

$15 + 15 + 5 = 35 \text{ ft}^3$

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.

$\frac{35}{2} = 17.5$ 18 bags $18 \cdot 3.68 =$

Score 3: The student did not determine the cost of the number of bags of topsoil.

Question 33

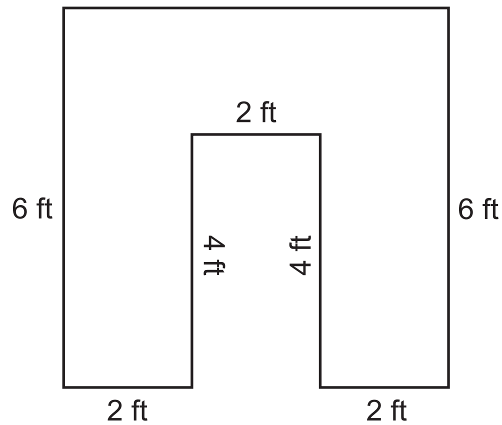
33 A garden bed, pictured below, is a square prism with a rectangular prism taken out. The inside length of the square prism is 6 feet. The rectangular prism taken out has a width of 2 feet and a length of 4 feet.

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

6

Garden Bed

Top View of Garden Bed



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

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

$6+6+2+4+2+4+2+6$

32

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.

$\frac{32}{2}=16$ $\quad 3.68 \times 16$

\$58.88

Score 2: The student did not determine the volume, but found an appropriate cost.

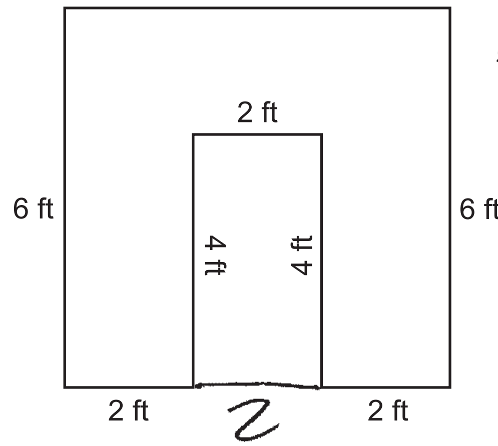
Question 33

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



$6 \cdot 6 = 36$
$2 \cdot 4 = 8$

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

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

$36 - 8 = 28$

28.

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.

$\frac{28}{2} = 14 \quad 14 \times 3.68$

$= 51.52$ bags

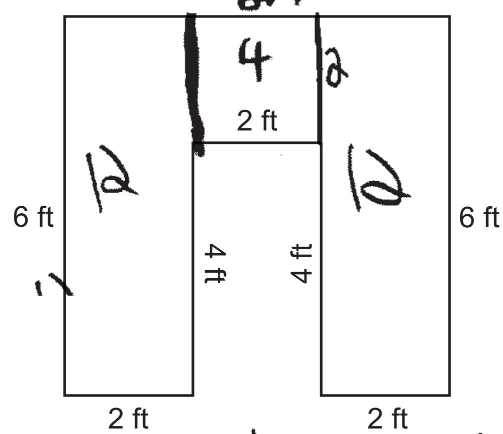
Score 2: The student correctly determined the area of the base of the garden bed. The student made an error when labeling the cost.

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



LxW

$6 \cdot 2 = 12$
$2 \cdot 2 = 4$

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

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

$12 + 4 + 12 = 28$

28×1.25
35 cb ft

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.

Score 2: The student correctly determined the volume of the topsoil in the garden bed.

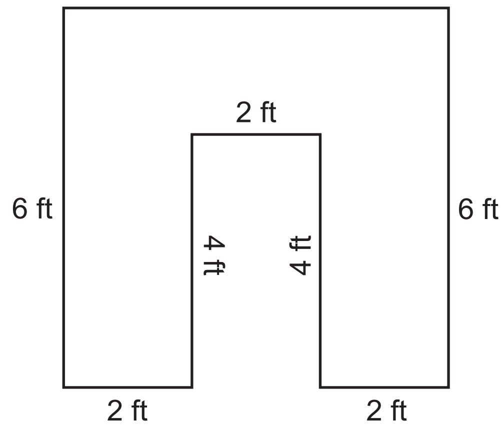
Question 33

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.

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

$V = 35\text{ ft}^3$

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.

18 bags

\$66.24

Score 1: The student wrote correct answers, but did not show work.

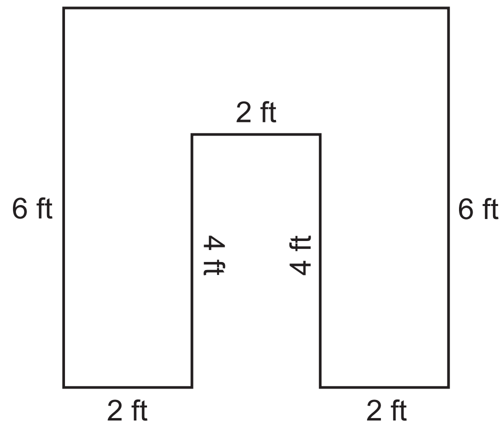
Question 33

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.

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

$6 \cdot 6 = 36$
$4 \cdot 2 = 8$
$= 28$

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.

$28 \cdot 2 = 56$ bags needed

Score 1: The student correctly determined the area of the base of the garden bed.

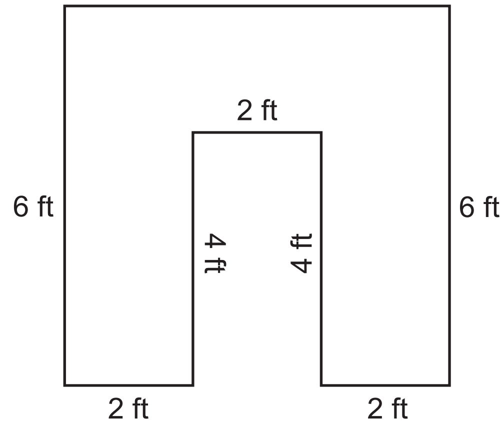
Question 33

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.

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

$V = L \cdot W \cdot H$

$L = 2 \quad W = 4 \quad H = 6$

$2 + 2 + 2 = 6$
$4 + 4 = 8$
$6 + 6 + 6 = 18$

$V = (6)(8)(18)$
$V = 846 \text{ ft}^3$

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.

3.68×2
$= \$7.38$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

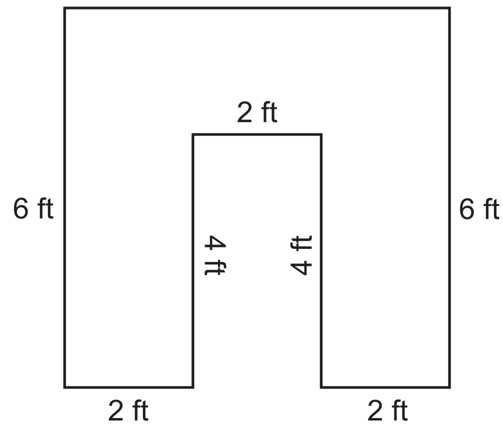
Question 33

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.

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

$6 \times 2 \times 4 \times 1.25 = 60$

$\boxed{V=60}$

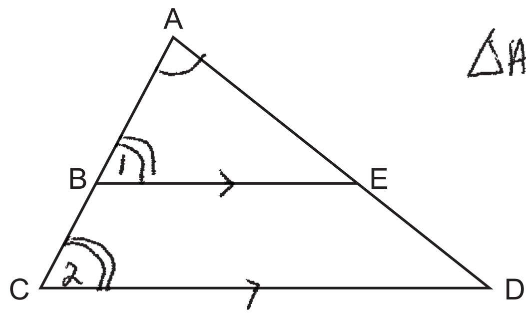
Each bag of topsoil sells for \$3.68 and contains 2 cubic feet of topsoil.

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

$3.68 \times 2 = \boxed{\$7.36}$

Score 0: The student did not show enough correct relevant course-level work to receive any credit.

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



$\triangle ABE \sim \triangle ACD$

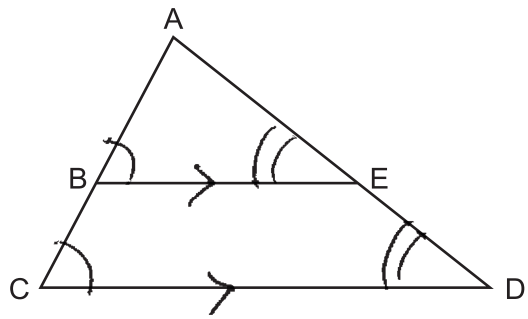
Prove: $AB \cdot AD = AE \cdot AC$

Statements	Reasons
1) $\triangle ACD$ with $\overline{ABC}$, $\overline{AED}$, and $\overline{BE} \parallel \overline{CD}$	1) Given
2) $\angle A \cong \angle A$	2) reflexive prop.
3) $\angle 1 \cong \angle 2$	3) $\parallel$ lines cut by a transversal form $\cong$ corresponding $\angle$s.
4) $\triangle ABE \sim \triangle ACD$	4) AA $\sim$
5) $\dfrac{AB}{AE} = \dfrac{AC}{AD}$	5) corresponding sides of $\sim \triangle$'s are proportional
6) $AB \cdot AD = AE \cdot AC$	6) The product of the means = the product of the extremes.

Score 4: The student gave a complete and correct response.

Question 34

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

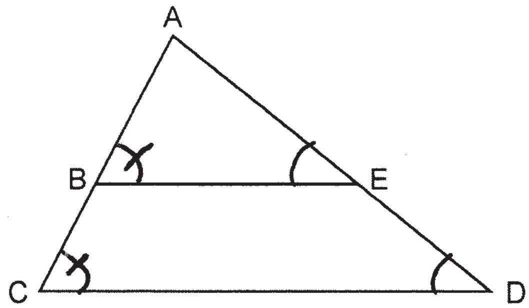


Prove: $AB \bullet AD = AE \bullet AC$

Statements	Reasons
(1) $\triangle ACD$, $\overline{ABC}$, $\overline{AED}$, $\overline{BE} \parallel \overline{CD}$	(1) Given
(2) $\angle ABE \cong \angle ACD$ $\angle AEB \cong \angle ADC$	(2) $\parallel \rightarrow \cong$ corresponding $\angle$'s
(3) $\triangle ABE \sim \triangle ACD$	(3) AA $\sim$
(4) $\frac{AB}{AC} = \frac{AE}{AD}$	(4) Similar $\triangle$s $\rightarrow$ proportional corresponding sides
(5) $AB \cdot AD = AE \cdot AC$	(5) Product of the means = Product of the extremes

Score 4: The student gave a complete and correct response.

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



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

$\boxed{\triangle ACD, \overline{ABC}, \overline{AED}, \overline{BE} \parallel \overline{CD}}$

Given

$\downarrow$

$\boxed{\angle ABE \cong \angle C, \quad \angle AEB \cong \angle D}$

Parallel lines form congruent corresponding angles

$\downarrow$

$\boxed{\triangle ABE \sim \triangle ACD}$

AA Similarity

$\downarrow$

$\boxed{\frac{AB}{AE} = \frac{AC}{AD}}$

Corresponding Sides of Similar Triangles are proportional

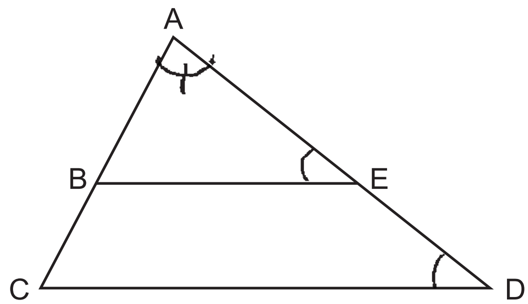
$\downarrow$

$\boxed{AB \cdot AD = AE \cdot AC}$

Product of Means = Product of Extremes

Score 4: The student gave a complete and correct response.

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



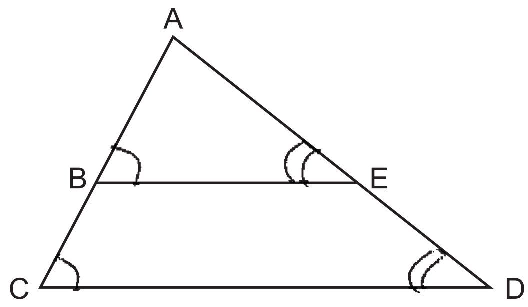
Prove: $AB \cdot AD = AE \cdot AC$

Statements	Reasons
1. $\triangle ACD$, $\overline{BE} \parallel \overline{CD}$, $\overline{ABC}$, $\overline{AED}$	1. Given
2. $\angle A \cong \angle A$	2. Reflexive
3. $\angle AEB \cong \angle ADC$	3. If lines are //, consecutive exterior $\angle$s are $\cong$
4. $\triangle ABE \sim \triangle ACD$	4. AA Similarity
5. $\frac{AB}{AE} = \frac{AC}{AD}$	5. Corresponding sides of similar triangles are proportional.
6. $AB \cdot AD = AE \cdot AC$	6. product of means = product of extremes

Score 3: The student wrote an incorrect reason in step 3.

Question 34

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



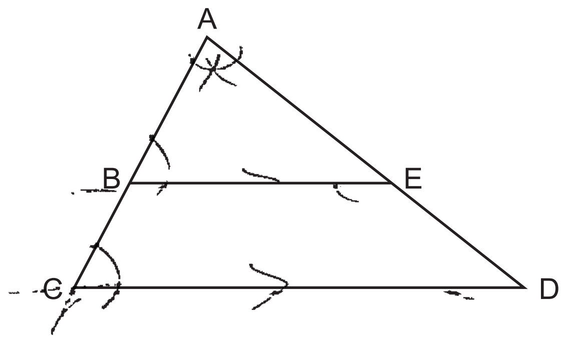
Prove: $AB \cdot AD = AE \cdot AC$

1. $\triangle ACD$, $\overline{ABC}$, $\overline{AED}$ $\overline{BE} \parallel \overline{CD}$	1. Given
2. $\angle ABE \cong \angle C$ $\angle AEB \cong \angle D$	2. If 2 parallel lines are cut by a transversal, the corresponding angles are $\cong$.
3. $\triangle ABE \sim \triangle ACD$	3. $AA \cong AA$
4. $\frac{AE}{AB} = \frac{AD}{AC}$	4. CPCTC
5. $AB \cdot AD = AE \cdot AC$	5. In a proportion, the product of the means equals the product of the extremes.

Score 3: The student wrote an incorrect reason in step 4.

Question 34

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



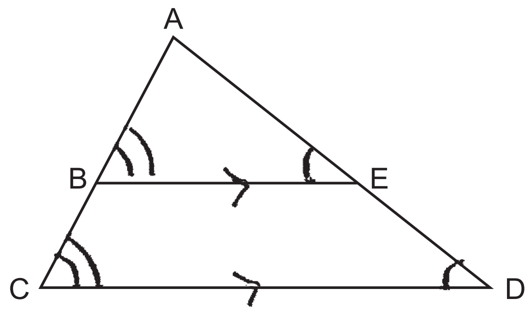
Prove: $AB \cdot AD = AE \cdot AC$

Statement	Reason
1) $\triangle ACD$ w/ $\overline{ABC}$, $\overline{AED}$, & $\overline{BE} \parallel \overline{CD}$	1) Given
2) $\angle ABE \cong \angle ACD$ $\angle AEB \cong \angle ADC$	2) corresp parts of $\cong$ Δ's are $\cong$
3) $\angle A \cong \angle A$	3) reflexive property
4) $\Delta ABE \cong \Delta ACD$	4) AA~AA
5) $\frac{AB}{AE} = \frac{AC}{AD}$	5) in similar Δ's all corresp sides are in proportion
6) $AB \cdot AD = AE \cdot AC$	6) product of the means = product of the extremes

Score 2: The student wrote an incorrect reason in step 2 and an incorrect statement in step 4.

Question 34

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



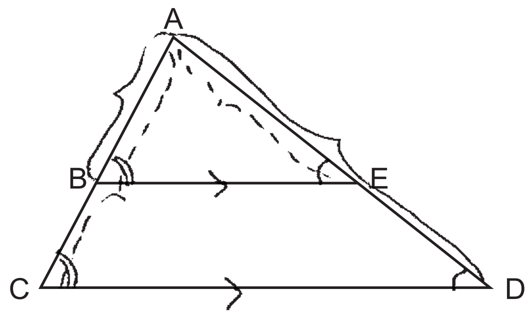
Prove: $AB \bullet AD = AE \bullet AC$

statements	reasons
1. $\triangle ACD$, $\overline{ABC}$, $\overline{AED}$, $\overline{BE} \parallel \overline{CD}$	1. Given
2. $\angle A \cong \angle A$	2. Reflexive property
3. $\angle AEB \cong \angle ADC$	3. $\parallel \rightarrow$ corresponding $\angle$'s are $\cong$
4. $\triangle ABE \sim \triangle ACD$	4. AA~
5. $\frac{AB}{AC} = \frac{AE}{AD}$	5. Similar shapes have similar corresponding sides.
6. $AC \circ AE = AB \cdot AD$	6. Cross multipication

Score 2: The student wrote incorrect reasons in steps 5 and 6.

Question 34

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



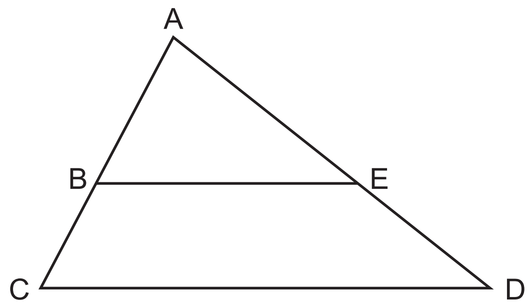
Prove: $AB \bullet AD = AE \bullet AC$

statement	reasoning
① $\triangle ACD$ w/ $\overline{ABC}$ $\overline{AED}$, $\overline{BE} \parallel \overline{CD}$	① Given
② $\measuredangle AEB \cong \measuredangle ADC$, $\angle ABE \cong \angle ACD$	② Alternate interior $\measuredangle$s are $\cong$
③ $\measuredangle A \cong \measuredangle A$	③ reflexive
④ $\triangle ABE \sim \triangle ACD$	④ AAA~
⑤ $AE : AD = AB : AC$	⑤ they are proportionate to each other
⑥ $AB \cdot AD = AE \cdot AC$	⑥ In similar $\triangle$s, the sides are proportionate to each other

Score 1: The student wrote incorrect reasons in steps 2, 5, and 6.

Question 34

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



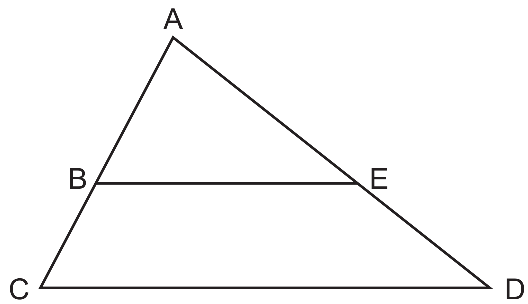
Prove: $AB \bullet AD = AE \bullet AC$

Statement	Reason
(1) ΔACD with $\overline{ABC}, \overline{AED}$ and $\overline{BE} \parallel \overline{CD}$	(1) given
(2) $\angle A \cong \angle A$	(2) Reflexive prop
(3) $\angle ABE \cong \angle ACD$	(3) $\parallel$ lines $\rightarrow \cong \angle$'s
(4) $\Delta ABE \sim \Delta ACD$	(4) AA$\sim$
(5) $AB \cdot AD = AE \cdot AC$	(5) Similar Δ's $\rightarrow \cdot$ Sides

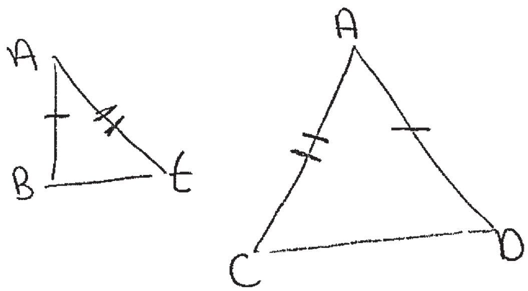
Score 1: The student wrote incorrect reasons in steps 3 and 5. The student was missing a statement and reason to prove step 5.

Question 34

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



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



AB ∘ AD = AE ∘ AC Because AB ∘ AD and AE ∘ AC are both set to a proportion. AB (smaller leg of Δ) times AD (longer leg of opposite side of Δ). And AE (smaller leg of Δ) times AC (longer leg of opposide side of Δ.) so setting up an equal propotion will make them equal.

Score 0: The student did not show enough relevant course-level work to receive any credit.

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 the next page is optional.]

Slope of $\overline{PT}$: $m = \frac{4+2}{-6+4} = \frac{6}{-2} = -3$

Slope of $\overline{PE}$: $m = \frac{8-4}{6+6} = \frac{4}{12} = \frac{1}{3}$

The slope of $\overline{PT}$ is a negative reciprocal of the slope of $\overline{PE}$ which indicates that $\overline{PT} \perp \overline{PE}$.

$\perp$ lines forms right angle P so ΔPET is a right triangle.

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

N : (8, 2)

Question 35 is continued on the next page.

Score 6: The student gave a complete and correct response.

Prove *PENT* is a rectangle.

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

Slope of $\overline{PT}$: $m = \frac{4+2}{-6+4} = \frac{6}{-2} = -3$

Slope of $\overline{PE}$: $m = \frac{8-4}{6+6} = \frac{1}{3}$

Slope of $\overline{EN}$: $m = \frac{8-2}{6-8} = \frac{6}{-2} = -3$

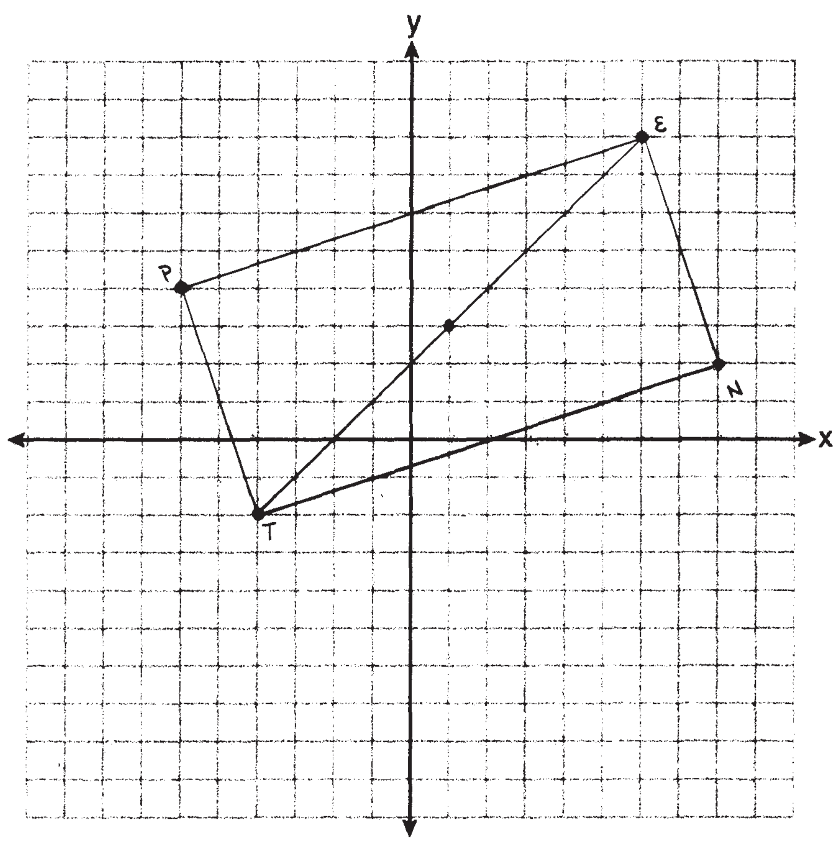
Slope of $\overline{NT}$: $m = \frac{2+2}{8+4} = \frac{4}{12} = \frac{1}{3}$

Since the slopes are negative reciprocals
$\overline{PT} \perp \overline{PE}$, $\overline{PE} \perp \overline{EN}$, $\overline{EN} \perp \overline{NT}$,

$\overline{NT} \perp \overline{PT}$

so $\angle P, \angle E, \angle N,$ + $\angle T$ are right $\angle$'s

PENT contains 4 right angles so PENT is a rectangle



Question 35

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 the next page is optional.]

$PE = \sqrt{(6--6)^2+(8-4)^2} = \sqrt{144+16} = \sqrt{160}$

$PT = \sqrt{(-4--6)^2+(-2-4)^2} = \sqrt{4+36} = \sqrt{40}$

$TE = \sqrt{(-4-6)^2+(-2-8)^2} = \sqrt{100+100} = \sqrt{200}$

Since $(\sqrt{160})^2+(\sqrt{40})^2=(\sqrt{200})^2$, Then ΔPET is a right triangle

$160+40=200$

$200=200$

because the Pythagorean Theorem holds true.

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

$N(8,2)$

Question 35 is continued on the next page.

Score 6: The student gave a complete and correct response.

Prove *PENT* is a rectangle.

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

$m_{\overline{PT}} = \frac{-2-4}{-4-(-6)} = \frac{-6}{2} = -3$

$m_{\overline{EN}} = \frac{8-2}{6-8} = \frac{+6}{-2} = -3$

Same slopes $\Rightarrow \overline{PT} \parallel \overline{EN}$

$m_{\overline{PE}} = \frac{8-4}{6-(-6)} = \frac{4}{12} = \frac{1}{3}$

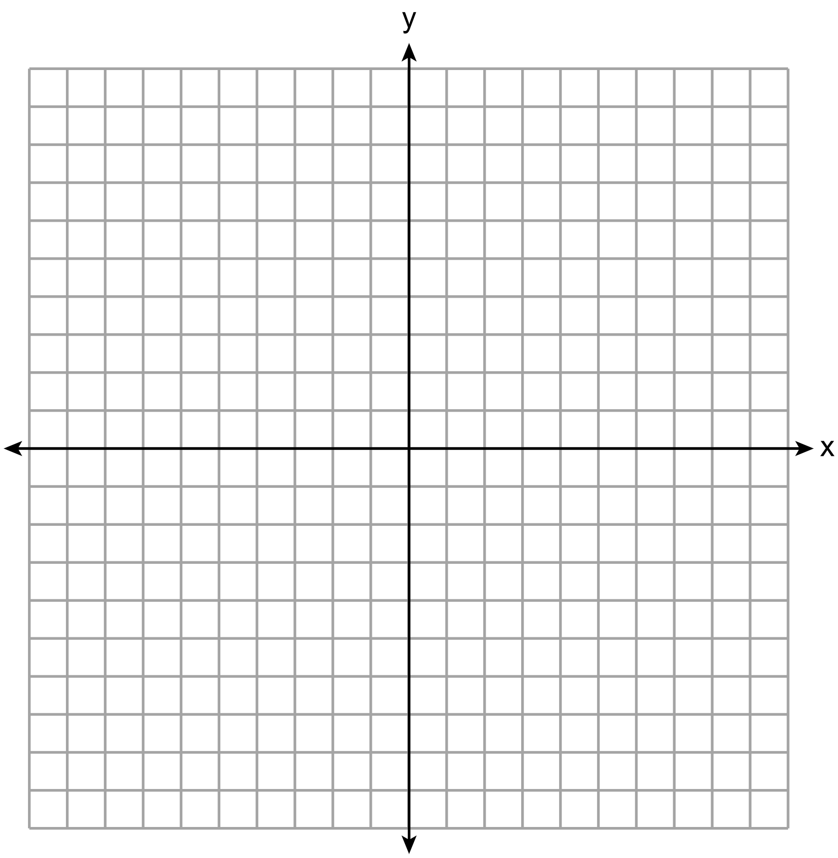
$m_{\overline{TN}} = \frac{-2-2}{-4-8} = \frac{-4}{-12} = \frac{1}{3}$

Same slopes $\Rightarrow \overline{PE} \parallel \overline{TN}$

* Since both pairs of opp. sides are $\parallel$, PENT is a $\parallel$ogram.

* Since the slopes of $\overline{PT}$ and $\overline{PE}$ are negative reciprocals, $\overline{PT} \perp \overline{PE}$ making $\angle P$ a right $\angle$.

$\Rightarrow$ A $\parallel$ogram w/ a right $\angle$ is a rectangle, therefore PENT is a rectangle.



Question 35

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 the next page is optional.]

slope of $\overline{PE}$ = $\begin{matrix}-6,4\\6,8\end{matrix}$ $\quad \frac{8-4}{6-(-6)} \rightarrow \frac{4}{12} \rightarrow \boxed{\frac{1}{3}}$

slope of $\overline{PT}$ = $\begin{matrix}-6,4\\-4,-2\end{matrix}$ $\quad \frac{-2-4}{-4(-6)} \rightarrow \frac{-6}{2} \rightarrow -3$

$\triangle PET$ is a right triangle.

since $\overline{PE}$ and $\overline{PT}$ are $\perp$, $\angle EPT$ is right. A triangle with a right angle is a right triangle.

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

(8,2)

Question 35 is continued on the next page.

Score 5: The student had an incomplete concluding statement in not stating the slopes of $\overline{PE}$ and $\overline{PT}$ were negative reciprocals.

Prove *PENT* is a rectangle.

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

slope $\overline{PE} = \frac{8-4}{6-(-6)} \to \frac{1}{3}$

slope $\overline{PT} = \frac{-2-4}{-4-(-6)} \to -3$

slope $\overline{TN} = \frac{2-(-2)}{8-(-4)} \to \frac{1}{3}$

slope $\overline{EN} = \frac{2-8}{8-6} = \frac{-6}{2} \to -3$

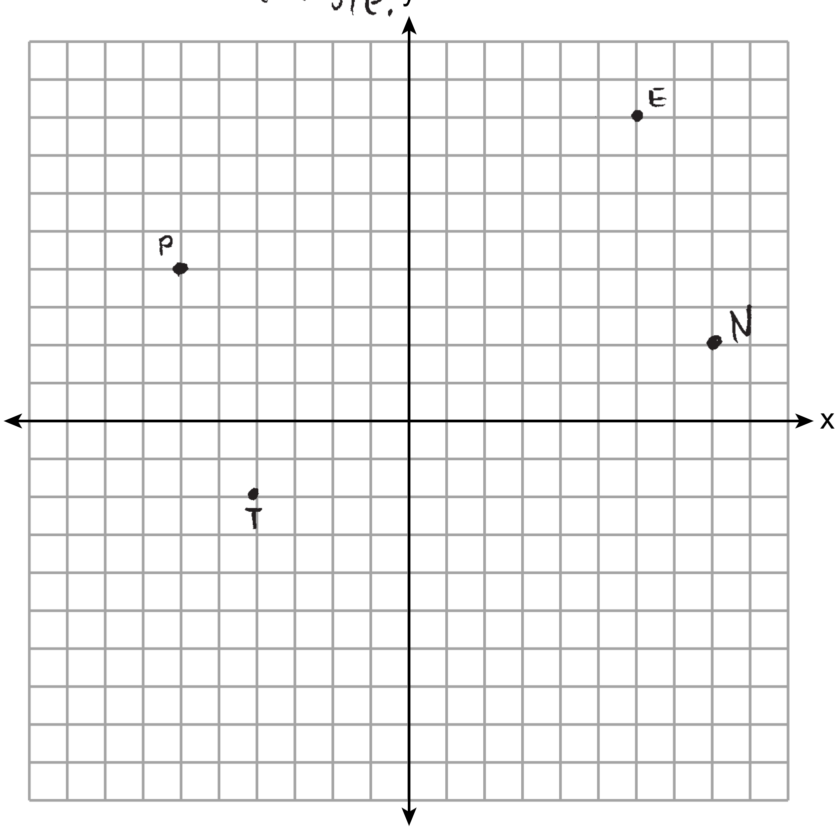
$\parallel$

$\parallel$

$\overline{PE} \perp \overline{PT}$
$\angle EPT = 90^\circ$

$\overline{PE} \parallel \overline{TN}$
$\overline{EN} \parallel \overline{PT}$

Quadrilateral PENT is a Parallelogram because opposite sides are parallel. ($\overline{PE} \parallel \overline{TN}$ and $\overline{EN} \parallel \overline{PT}$) since two sides $\overline{PE}$ and $\overline{PT}$ are $\perp$ $\angle EPT$ is a right angle. A Parallelogram with a right angle is a rectangle so PENT is a rectangle.



Question 35

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 the next page is optional.]

$m = \frac{RISE}{RUN}$ $m_{\overline{PE}} = \frac{4}{12} = \frac{1}{3}$

$m_{\overline{PT}} = \frac{-6}{2} = -3$ $\Big\rangle \perp$

neg recip slopes $\Rightarrow \perp$

$\therefore \angle P$ is a right $\measuredangle$

ΔPET is a right Δ because it has a right angle ($\overline{PE} \perp \overline{PT}$)

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

N (8 , 2)

Question 35 is continued on the next page.

Score 5: The student wrote an incomplete concluding statement when proving the rectangle.

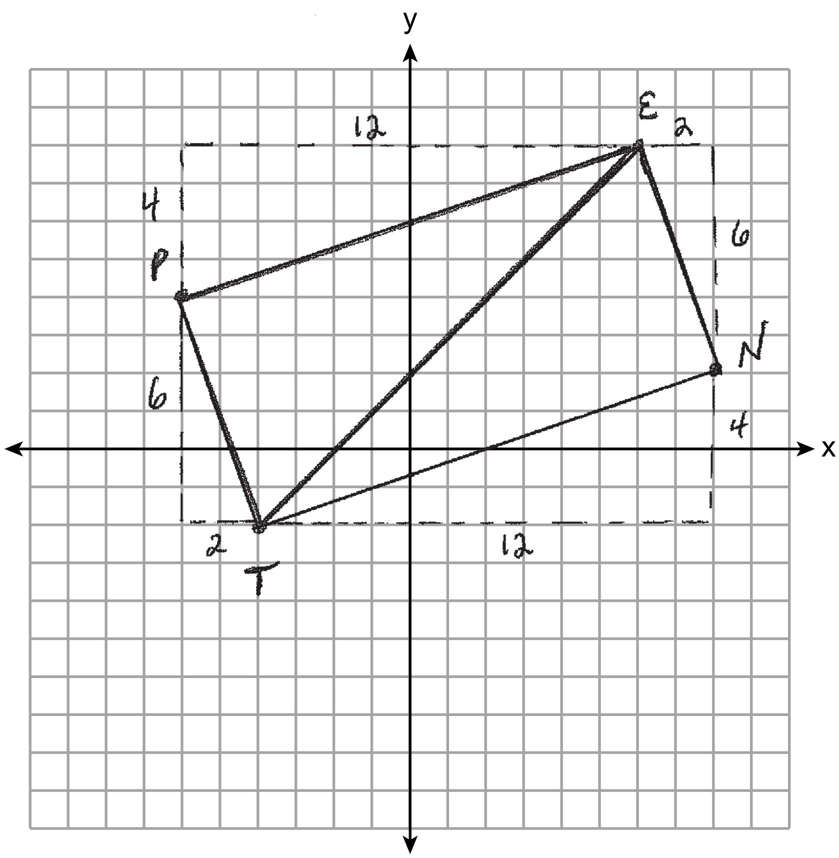
Prove *PENT* is a rectangle.

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

$m_{\overline{PE}} = \frac{1}{3}$
$m_{\overline{TN}} = \frac{4}{12} = \frac{1}{3}$ $\Big\rangle \parallel$

$m_{\overline{EN}} = \frac{-6}{2} = -3$
$m_{\overline{PT}} = -3$ $\Big\rangle \parallel$

$\therefore$ PENT is a rectangle because it has a pair of opp. sides $\parallel$
It has a right $\measuredangle$ at P.



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 the next page is optional.]

$PE = \sqrt{(6-(-6))^2 + (8-4)^2}$
$= \sqrt{12^2 + 4^2}$
$= \sqrt{144+16}$
$PE = \sqrt{160}$

$PT = \sqrt{(-4-(-6))^2 + (-2-4)^2}$
$= \sqrt{2^2 + (-6)^2}$
$= \sqrt{4+36}$
$PT = \sqrt{40}$

$ET = \sqrt{(-4-6)^2 + (-2-8)^2}$
$= \sqrt{(-10)^2 + (-10)^2}$
$= \sqrt{100+100}$
$ET = \sqrt{200}$

$\sqrt{160}^2 + \sqrt{40}^2 = \sqrt{200}^2$

$160 + 40 = 200$

$200 = 200$ ✓

Since the pythagorean Theorem works, $\triangle PET$ is a right triangle

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

$N(8,2)$

Question 35 is continued on the next page.

Score 5: The student wrote an incorrect concluding statement when proving *PENT* was a parallelogram.

Prove *PENT* is a rectangle.

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

$PN = \sqrt{(8-(-6))^2 + (2-4)^2}$

$= \sqrt{14^2 + (-2)^2}$

$= \sqrt{196+4}$

$PN = \sqrt{200}$

$ET = \sqrt{200}$

Diagonals

$\overline{PN} \cong \overline{NT}$

$EN = \sqrt{(8-6)^2 + (2-8)^2}$

$= \sqrt{2^2 + (-6)^2}$

$= \sqrt{4+36}$

$= \sqrt{40}$

$TN = \sqrt{(8-(-4))^2 + (2-(-2))^2}$

$= \sqrt{12^2 + 4^2}$

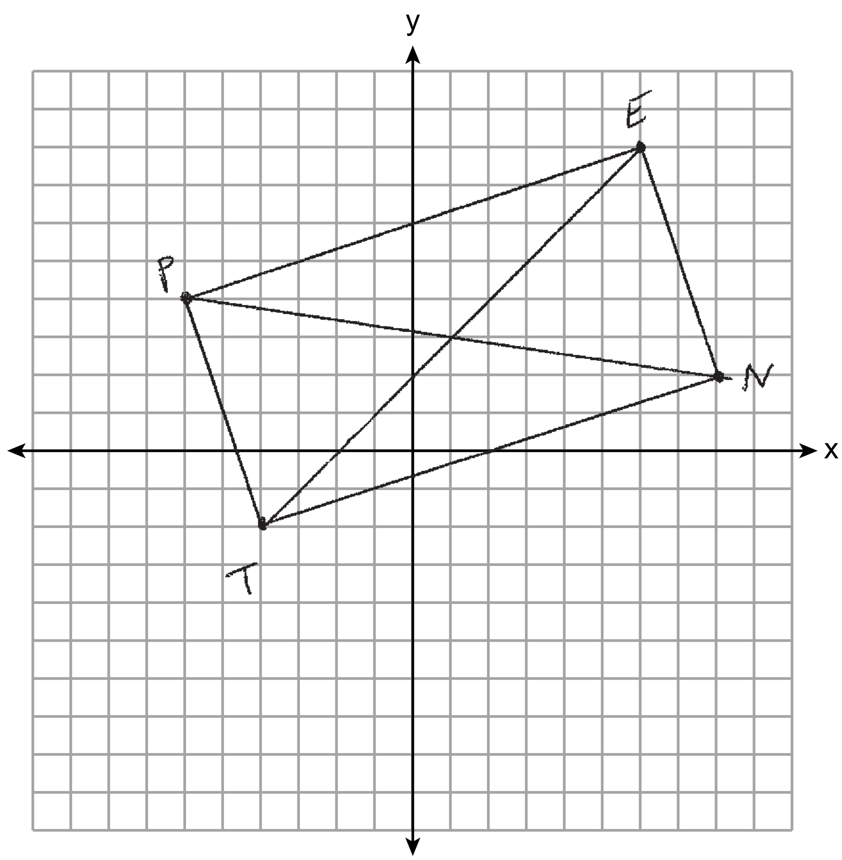
$= \sqrt{144+16}$

$= \sqrt{160}$

$\overline{PT} \cong \overline{EN}$

$\overline{PE} \cong \overline{TN}$

Since both pairs of opposite sides of quad PENT are ∥, it is a parallelogram. Since ▱ PENT has ≅ diagonals, it is a rectangle



Question 35

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 the next page is optional.]

$m\overline{PE}$ $\frac{4}{12} = \frac{1}{3}$

$m\overline{ET}$ $\frac{10}{10} = 1$

$m\overline{TP}$ $\frac{-6}{2} = \frac{-3}{1}$

- reciprocal slopes $\perp$

$\therefore \overline{PE} \perp \overline{TP}$

ΔPET is a right Δ b/c $\perp \rightarrow$ right $\angle P$

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

N (8,3)

Question 35 is continued on the next page.

Score 4: The student wrote an incorrect coordinate for point *N* and had an incomplete conclusion when proving the rectangle.

Question 35 continued.

Prove *PENT* is a rectangle.

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

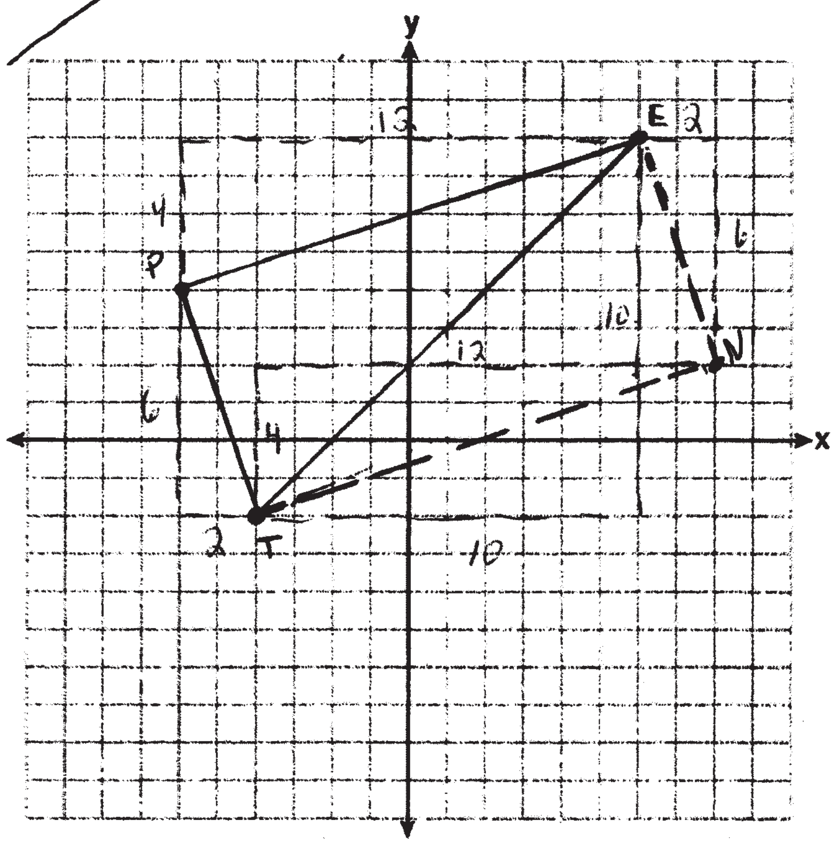
$m\overline{PE} = \frac{4}{12} = \frac{1}{3}$ — reciprocal slopes $\perp$

$m\overline{EN} = \frac{-6}{2} = \frac{-3}{1}$ — same slope $\parallel$

$m\overline{NT} = \frac{4}{12} = \frac{1}{3}$

$m\overline{TP} = \frac{-6}{2} = \frac{-3}{1}$

PENT is a rectangle b/c $\perp$ → rt $\angle$'s & same slope → $\parallel$



Question 35

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 the next page is optional.]

$10^2 + 10^2 = ET^2$

$100 + 100 = ET^2$

$\sqrt{200} = \sqrt{ET^2}$

$ET = \sqrt{200}$

$12^2 + 4^2 = PE^2$

$144 + 16 = PE^2$

$\sqrt{160} = \sqrt{PE^2}$

$PE = \sqrt{160}$

$6^2 + 2^2 = PT^2$

$36 + 4 = PT^2$

$\sqrt{40} = \sqrt{PT^2}$

$PT = \sqrt{40}$

$\triangle PET$ is a right triangle because it has three unequal sized.

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

N (8,2)

Question 35 is continued on the next page.

Score 3: The student wrote an incorrect conclusion when proving the right triangle and made a conceptual error when proving the rectangle.

Prove *PENT* is a rectangle.

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

$4^2 + 12^2 = PE^2$

$\sqrt{160} = \sqrt{PE^2}$

$PE = \sqrt{160}$

$6^2 + 2^2 = EN^2$

$\sqrt{40} = EN$

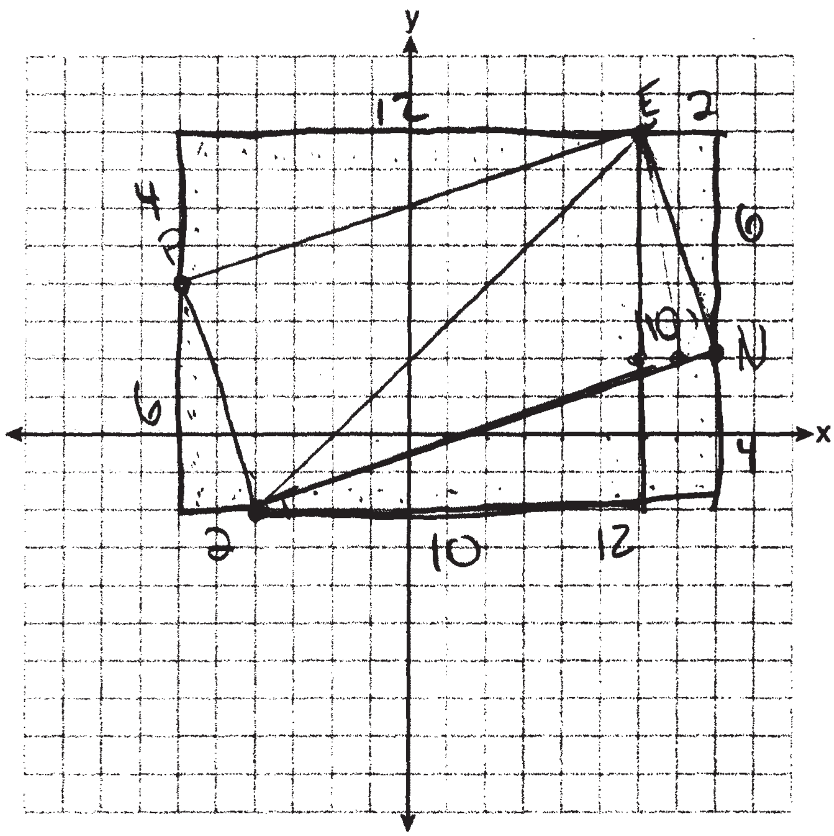
$12^2 + 4^2 = TN^2$

$\sqrt{160} = TN$

$6^2 + 2^2 = PT^2$

$\sqrt{40} = PT$

there are two pair of congruent opposite sides therefore PENT is a rectangle



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 the next page is optional.]

Slope

$\overline{PT}$ $\frac{-2-4}{-4+6} = \frac{-6}{2} = 3$

$\overline{PE}$ $\frac{8-4}{6+6} = \frac{4}{12} = \frac{1}{3}$

neg recip slopes

$\overline{PT} \perp \overline{PE}$

$\angle P$ is a Right $\angle$

Since $\angle P$ is a Right angle $\triangle PET$ is a Right $\triangle$

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

N(8,2)

Question 35 is continued on the next page.

Score 3: The student made a computational error when reducing $-\frac{6}{2}$ and made a conceptual error stating a quadrilateral with congruent diagonals was a rectangle.

Prove *PENT* is a rectangle.

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

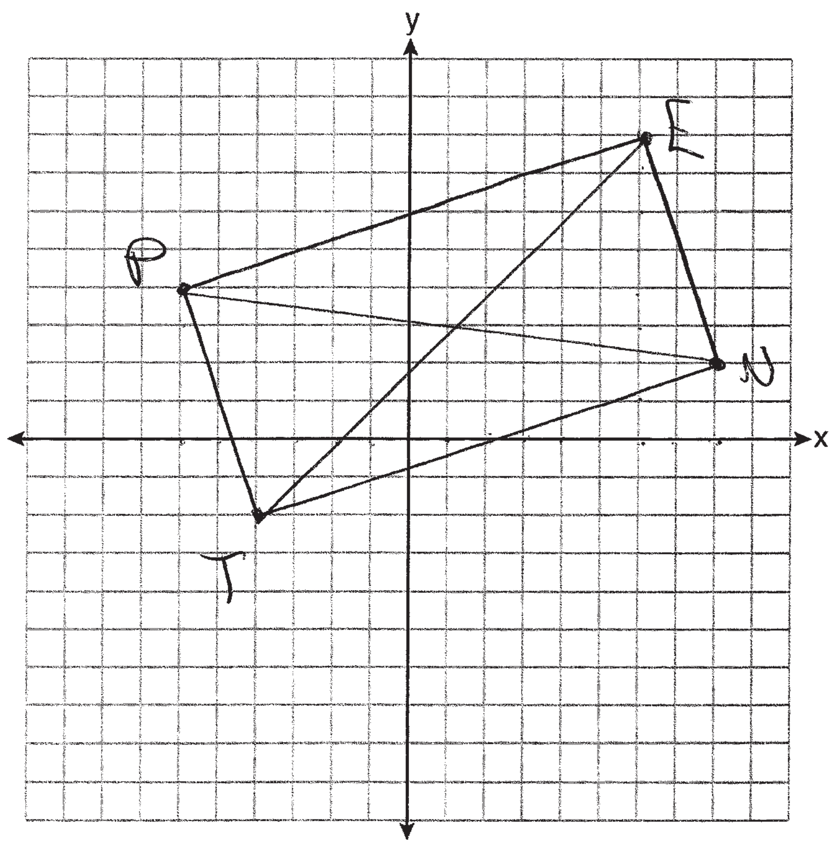
P(−6,4) E(6,8) N(8,2) T(−4,−2)

$PN = \sqrt{(-6-8)^2 + (4-2)^2}$ $TE = \sqrt{(6+4)^2 + (8+2)^2}$

$PN = \sqrt{196 + 4}$ $TE = \sqrt{100 + 100}$

$PN = \sqrt{200}$ $TE = \sqrt{200}$

Since the diagonals are congruent, PENT is a Rectangle.



Question 35

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 the next page is optional.]

forgot how to prove angles

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

N (8,2)

Question 35 is continued on the next page.

Score 2: The student correctly determined the coordinates of point *N* and determined the lengths of the four sides of *PENT*.

Prove *PENT* is a rectangle.

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

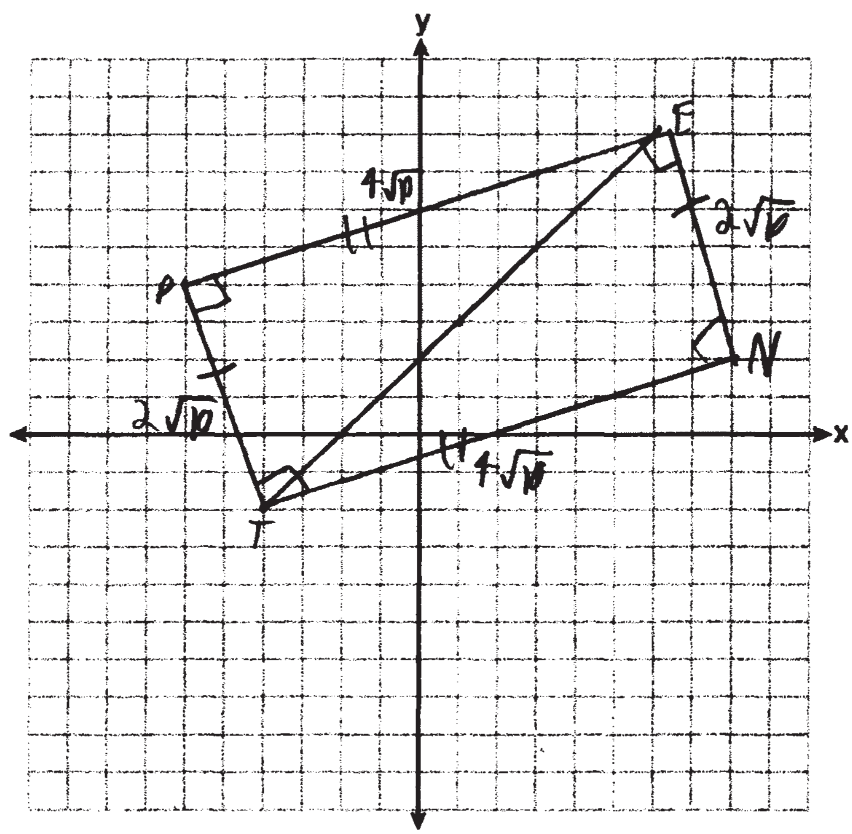
$\overline{PE} = \sqrt{(6+6)^2+(8-4)^2} = 4\sqrt{10}$

$\overline{TN} = \sqrt{(8+4)^2+(2+2)^2} = 4\sqrt{10}$

$\overline{TP} = \sqrt{(-6+4)^2+(4+2)^2} = 2\sqrt{10}$

$\overline{EN} = \sqrt{(6-8)^2+(8-2)^2} = 2\sqrt{10}$

PENT has 4 right angles and 2 pairs of congruent sides.



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 the next page is optional.]

$\overline{PE}$ $\frac{4-8}{-6-6} = \frac{-4}{-12} = \frac{1}{3}$

~~$\overline{ET}$ $\frac{8+2}{6+4} = \frac{10}{10}$~~ $\overline{PT}$ $\frac{4+2}{-6+4} = \frac{6}{-2} = \frac{3}{1}$

$\angle P$ is a right angle because slopes of $\overline{PE}$ & $\overline{PT}$ are negative reciprocals

Forming $\overline{PE} \perp \overline{PT}$ and $\triangle PET$ is a right $\triangle$.

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

(8,2)

Question 35 is continued on the next page.

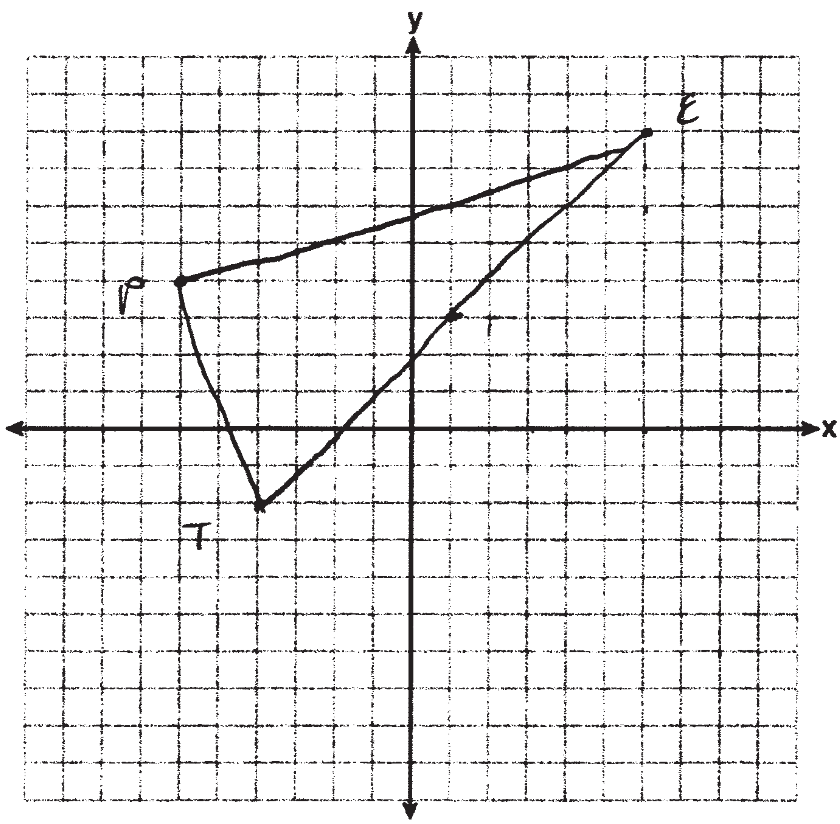
Score 2: The student made a computational error when reducing $\frac{6}{-2}$. The student correctly determined the coordinates of point *N*. No further correct work was shown.

Prove *PENT* is a rectangle.

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

∠P is a right angle since $\overline{PE}$ & $\overline{PT}$ are negatireve reciprirals

So since it has 4 sides that also makes it a rectangle



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 the next page is optional.]

$m\overline{PT}\ \frac{4-(-2)}{-6-(-4)} = \frac{6}{-2} = \frac{3}{-1}$

$m\overline{PE}\ \frac{8-4}{6-(-6)} = \frac{4}{12} = \frac{1}{3}$

$\overline{PT}$ and $\overline{PE}$ have negative reciprocal slopes of $\frac{3}{-1}$ and $\frac{1}{3}$, making them $\perp$, since $\perp$ lines form right $\angle$'s $\triangle PET$ is a right $\triangle$

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

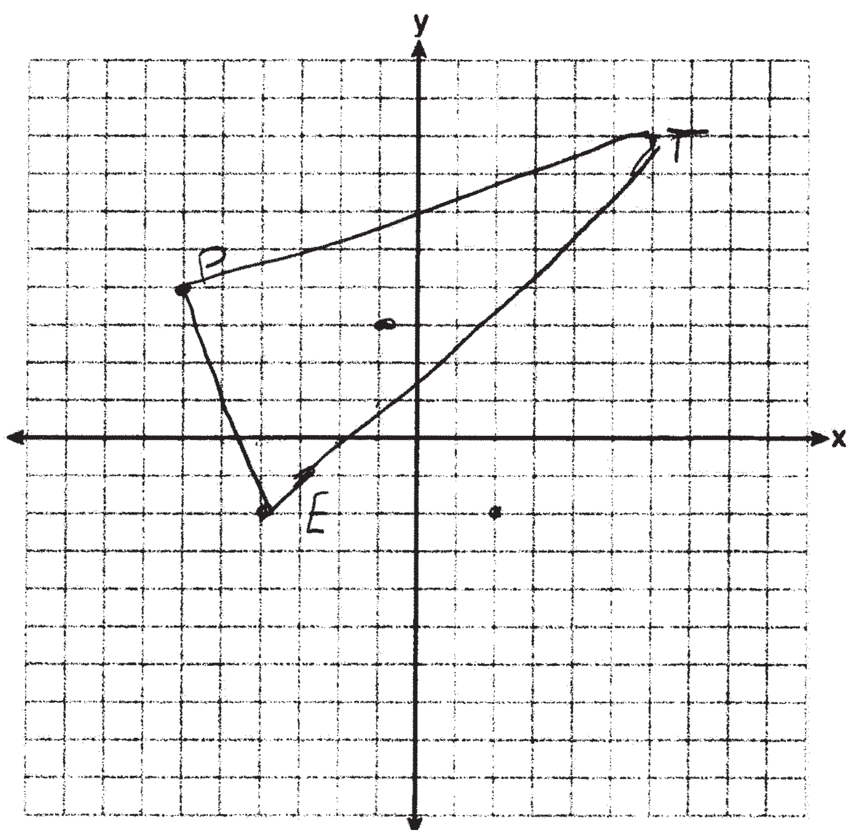
$N(2,-2)$

Question 35 is continued on the next page.

Score 2: The student correctly proved $\triangle PET$ was a right triangle. No further correct work was shown.

Prove *PENT* is a rectangle.

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



Question 35

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 the next page is optional.]

Statement	Reason
ΔPET has vertices with coordinates P, E, and T	Given
$\overline{PE} \perp \overline{PT}$	Definition of perpendicular lines
$\angle EPT$ is a right angle	Definition of right angle
ΔPET is a right triangle	Definition of a right triangle

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

$\boxed{N(8,2)}$

Question 35 is continued on the next page.

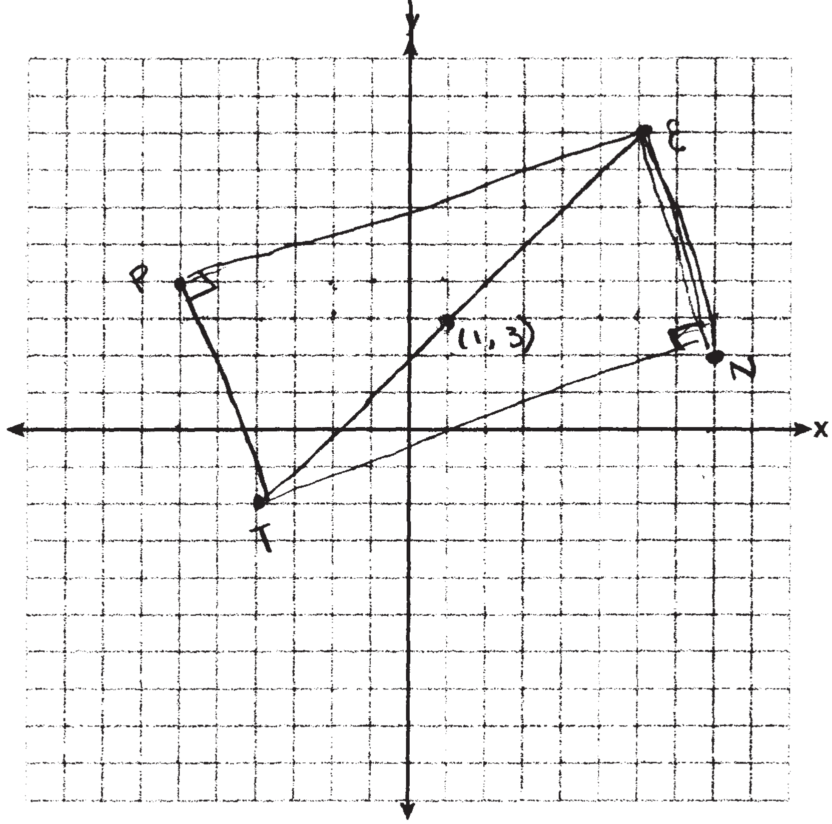
Score 1: The student correctly determined the coordinates of point N.

Question 35 continued.

Prove *PENT* is a rectangle.

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

Statement	Reason
$\overline{EN} \perp \overline{TN}$	Definition of perpendicular lines
$\angle ENT$ is a right angle	Definition of right angle
PENT is a rectangle	Definition of a rectangle

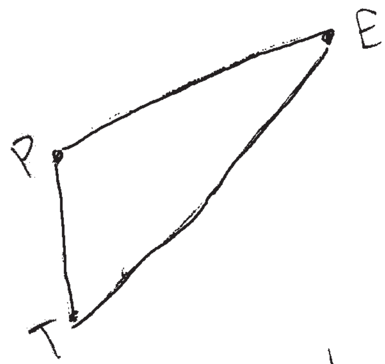


Question 35

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 the next page is optional.]



$\triangle PET$ is a right triangle because $\overline{TP}$ and $\overline{EP}$ are perpendicur

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

(8,2)

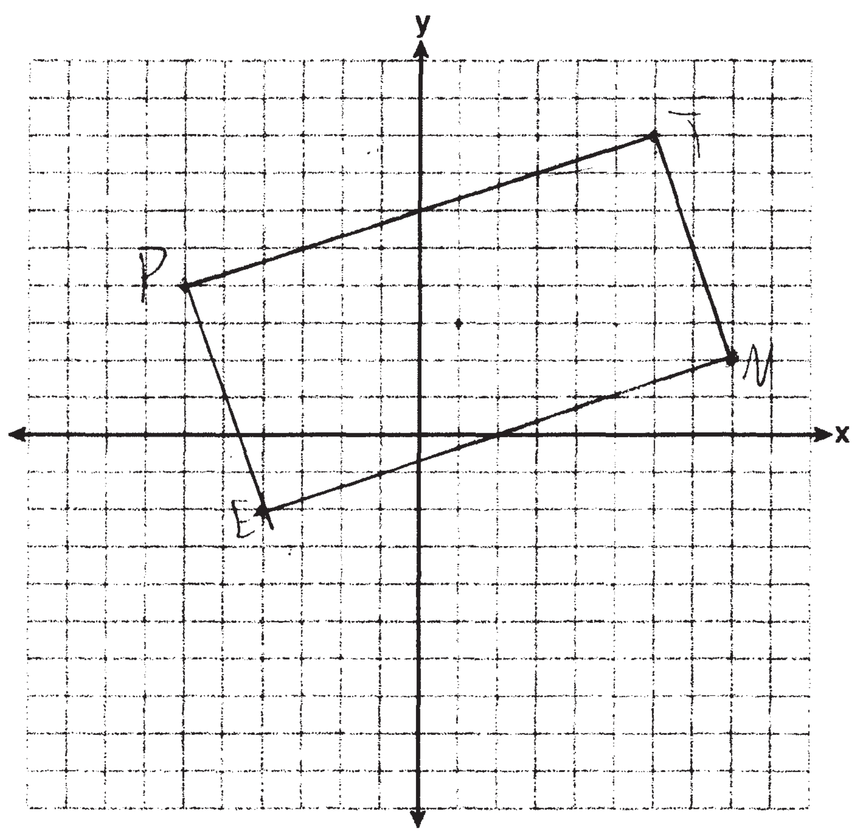
Question 35 is continued on the next page.

Score 1: The student correctly determined the coordinates of point *N*.

Prove *PENT* is a rectangle.

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

All of the lines have perpendicular slopes to the lines they touch



Question 35

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 the next page is optional.]

$\triangle PET$ is a right triangle because it has a $90°$ angle.

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

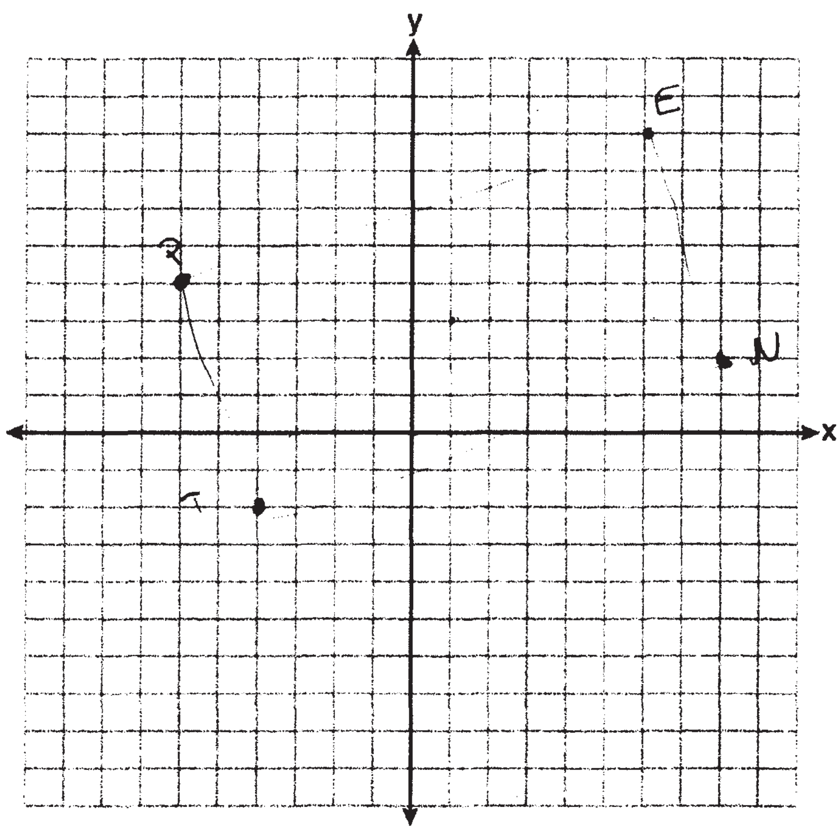
Question 35 is continued on the next page.

Score 0: The student did not show enough correct relevant work to receive any credit.

Prove *PENT* is a rectangle.

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

PENT is a rectangle because $\overline{PT} \cong \overline{EN}$, and $\overline{PE} \cong \overline{TN}$

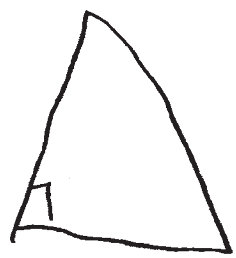


Question 35

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 the next page is optional.]



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

P(-6,4)
E(6,8)
T(-4,-2)
P'(-6,12) E'(6,24) T'(-4,6)

Question 35 is continued on the next page.

Score 0: The student did not show enough correct relevant work to receive any credit.

Prove *PENT* is a rectangle.

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