# Question ID a0d55a7e

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: a0d55a7e**

In convex pentagon $ABCDE$, segment $AB$ is parallel to segment $DE$. The measure of angle $B$ is $139$ degrees, and the measure of angle $D$ is $174$ degrees. What is the measure, in degrees, of angle $C$?

**ID: a0d55a7e Answer**

Correct Answer: 47

Rationale

The correct answer is $47$. It's given that the measure of angle $B$ is $139$ degrees. Therefore, the exterior angle formed by extending segment $AB$ at point $B$ has measure $180 - 139$, or $41$, degrees. It's given that segment $AB$ is parallel to segment $DE$. Extending segment $BC$ at point $C$ and extending segment $DE$ at point $D$ until the two segments intersect results in a transversal that intersects two parallel line segments. One of these intersection points is point $B$, and let the other intersection point be point $X$. Since segment $AB$ is parallel to segment $DE$, alternate interior angles are congruent. Angle $CXD$ and the exterior angle formed by extending segment $AB$ at point $B$ are alternate interior angles. Therefore, the measure of angle $CXD$ is $41$ degrees. It's given that the measure of angle $D$ in pentagon $ABCDE$ is $174$ degrees. Therefore, angle $CDX$ has measure $180 - 174$, or $6$, degrees. Since angle $C$ in pentagon $ABCDE$ is an exterior angle of triangle $CDX$, it follows that the measure of angle $C$ is the sum of the measures of angles $CDX$ and $CXD$. Therefore, the measure, in degrees, of angle $C$ is $6 + 41$, or $47$.

Alternate approach: A line can be created that's perpendicular to segments $AB$ and $DE$ and passes through point $C$. Extending segments $AB$ and $DE$ at points $B$ and $D$, respectively, until they intersect this line yields two right triangles. Let these intersection points be point $X$ and point $Y$, and the two right triangles be triangle $BXC$ and triangle $DYC$. It's given that the measure of angle $B$ is $139$ degrees. Therefore, angle $CBX$ has measure $180 - 139$, or $41$, degrees. Since the measure of angle $CBX$ is $41$ degrees and the measure of angle $BXC$ is $90$ degrees, it follows that the measure of angle $XCB$ is $180 - 90 - 41$, or $49$, degrees. It's given that the measure of angle $D$ is $174$ degrees. Therefore, angle $YDC$ has measure $180 - 174$, or $6$, degrees. Since the measure of angle $YDC$ is $6$ degrees and the measure of angle $CYD$ is $90$ degrees, it follows that the measure of angle $DCY$ is $180 - 90 - 6$, or $84$, degrees. Since angles $XCB$, $DCY$, and angle $C$ in pentagon $ABCDE$ form segment $XY$, it follows that the sum of the measures of those angles is $180$ degrees. Therefore, the measure, in degrees, of angle $C$ is $180 - 49 - 84$, or $47$.

Question Difficulty: Hard

# Question ID aabd482e

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

## ID: aabd482e

In triangle $ABC$, the measure of angle $B$ is $90^\circ$ and $\overline{BD}$ is an altitude of the triangle. The length of $\overline{AB}$ is $15$ and the length of $\overline{AC}$ is $23$ greater than the length of $\overline{AB}$. What is the value of $\frac{BC}{BD}$?

A. $\frac{15}{38}$

B. $\frac{15}{23}$

C. $\frac{23}{15}$

D. $\frac{38}{15}$

## ID: aabd482e Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that in triangle $ABC$, the measure of angle $B$ is $90^\circ$ and $\overline{BD}$ is an altitude of the triangle. Therefore, the measure of angle $BDC$ is $90^\circ$. It follows that angle $B$ is congruent to angle $D$ and angle $C$ is congruent to angle $C$. By the angle-angle similarity postulate, triangle $ABC$ is similar to triangle $BDC$. Since triangles $ABC$ and $BDC$ are similar, it follows that $\frac{AC}{AB} = \frac{BC}{BD}$. It's also given that the length of $\overline{AB}$ is $15$ and the length of $\overline{AC}$ is $23$ greater than the length of $\overline{AB}$. Therefore, the length of $\overline{AC}$ is $15 + 23$, or $38$. Substituting $15$ for $AB$ and $38$ for $AC$ in the equation $\frac{AC}{AB} = \frac{BC}{BD}$ yields $\frac{38}{15} = \frac{BC}{BD}$. Therefore, the value of $\frac{BC}{BD}$ is $\frac{38}{15}$.

Choice A is incorrect. This is the value of $\frac{BD}{BC}$.

Choice B is incorrect and may result from conceptual or calculation errors.

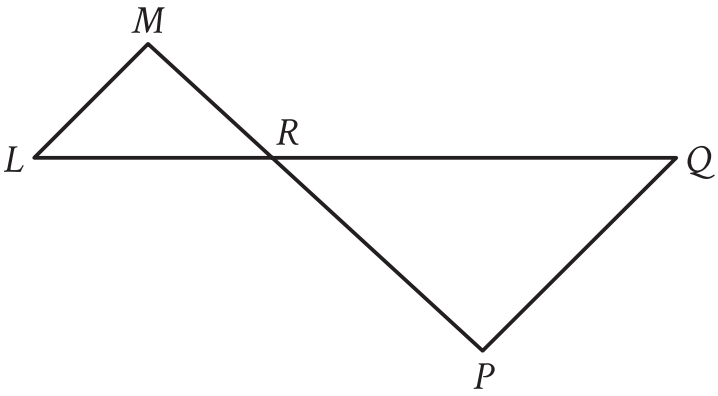
Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

# Question ID 4bedd065

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 4bedd065**




Note: Figure not drawn to scale.

In the figure, $\overline{LQ}$ intersects $\overline{MP}$ at point $R$, and $\overline{LM}$ is parallel to $\overline{PQ}$. The lengths of $\overline{MR}$, $\overline{LR}$, and $\overline{RP}$ are $6$, $7$, and $11$, respectively. What is the length of $\overline{LQ}$?

A. $\frac{119}{11}$

B. $\frac{77}{6}$

C. $\frac{113}{6}$

D. $\frac{119}{6}$

**ID: 4bedd065 Answer**

Correct Answer: D

Rationale

Choice D is correct. The figure shows that angle $MRL$ and angle $PRQ$ are vertical angles. Since vertical angles are congruent, angle $MRL$ and angle $PRQ$ are congruent. It's given that $\overline{LM}$ is parallel to $\overline{PQ}$. The figure also shows that $\overline{LQ}$ intersects $\overline{LM}$ and $\overline{PQ}$. If two parallel segments are intersected by a third segment, alternate interior angles are congruent. Thus, alternate interior angles $MLR$ and $PQR$ are congruent. Since triangles $LMR$ and $PQR$ have two pairs of congruent angles, the triangles are similar. Sides $LR$ and $MR$ in triangle $LMR$ correspond to sides $RQ$ and $RP$, respectively, in triangle $PQR$. Since the lengths of corresponding sides in similar triangles are proportional, it follows that $\frac{RQ}{LR} = \frac{RP}{MR}$. It's given that the lengths of $\overline{MR}$, $\overline{LR}$, and $\overline{RP}$ are $6$, $7$, and $11$, respectively. Substituting $6$ for $MR$, $7$ for $LR$, and $11$ for $RP$ in the equation $\frac{RQ}{LR} = \frac{RP}{MR}$ yields $\frac{RQ}{7} = \frac{11}{6}$. Multiplying each side of this equation by $7$ yields $RQ = \left(\frac{11}{6}\right)(7)$, or $RQ = \frac{77}{6}$. It's given that $\overline{LQ}$ intersects $\overline{MP}$ at point $R$, so $LQ = LR + RQ$. Substituting $7$ for $LR$ and $\frac{77}{6}$ for $RQ$ in this equation yields $LQ = 7 + \frac{77}{6}$, or $LQ = \frac{119}{6}$. Therefore, the length of $\overline{LQ}$ is $\frac{119}{6}$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect. This is the length of $\overline{RQ}$, not $\overline{LQ}$.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

# Question ID c3f47bd8

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: c3f47bd8**

In triangle $RST$, angle $T$ is a right angle, point $L$ lies on $\overline{RS}$, point $K$ lies on $\overline{ST}$, and $\overline{LK}$ is parallel to $\overline{RT}$. If the length of $\overline{RT}$ is $72$ units, the length of $\overline{LK}$ is $24$ units, and the area of triangle $RST$ is $792$ square units, what is the length of $\overline{KT}$, in units?

**ID: c3f47bd8 Answer**

Correct Answer: 14.66, 14.67, 44/3

Rationale

The correct answer is $\frac{44}{3}$. It's given that in triangle $RST$, angle $T$ is a right angle. The area of a right triangle can be found using the formula $A = \frac{1}{2}\ell_1\ell_2$, where $A$ represents the area of the right triangle, $\ell_1$ represents the length of one leg of the triangle, and $\ell_2$ represents the length of the other leg of the triangle. In triangle $RST$, the two legs are $\overline{RT}$ and $\overline{ST}$. Therefore, if the length of $\overline{RT}$ is $72$ and the area of triangle $RST$ is $792$, then $792 = \frac{1}{2}(72)(ST)$, or $792 = (36)(ST)$. Dividing both sides of this equation by $36$ yields $22 = ST$. Therefore, the length of $\overline{ST}$ is $22$. It's also given that point $L$ lies on $\overline{RS}$, point $K$ lies on $\overline{ST}$, and $\overline{LK}$ is parallel to $\overline{RT}$. It follows that angle $LKS$ is a right angle. Since triangles $RST$ and $LSK$ share angle $S$ and have right angles $T$ and $K$, respectively, triangles $RST$ and $LSK$ are similar triangles. Therefore, the ratio of the length of $\overline{RT}$ to the length of $\overline{LK}$ is equal to the ratio of the length of $\overline{ST}$ to the length of $\overline{SK}$. If the length of $\overline{RT}$ is $72$ and the length of $\overline{LK}$ is $24$, it follows that the ratio of the length of $\overline{RT}$ to the length of $\overline{LK}$ is $\frac{72}{24}$, or $3$, so the ratio of the length of $\overline{ST}$ to the length of $\overline{SK}$ is $3$. Therefore, $\frac{22}{SK} = 3$. Multiplying both sides of this equation by $SK$ yields $22 = (3)(SK)$. Dividing both sides of this equation by $3$ yields $\frac{22}{3} = SK$. Since the length of $\overline{ST}$, $22$, is the sum of the length of $\overline{SK}$, $\frac{22}{3}$, and the length of $\overline{KT}$, it follows that the length of $\overline{KT}$ is $22 - \frac{22}{3}$, or $\frac{44}{3}$. Note that 44/3, 14.66, and 14.67 are examples of ways to enter a correct answer.

Question Difficulty: Hard

# Question ID 75cef981

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 75cef981**

Triangles $PQR$ and $LMN$ are graphed in the *xy*-plane. Triangle $PQR$ has vertices $P$, $Q$, and $R$ at $(4, 5)$, $(4, 7)$, and $(6, 5)$, respectively. Triangle $LMN$ has vertices $L$, $M$, and $N$ at $(4, 5)$, $(4, 7 + k)$, and $(6 + k, 5)$, respectively, where $k$ is a positive constant. If the measure of $\angle Q$ is $t^\circ$, what is the measure of $\angle N$?

A. $(90 - (t - k, ))^\circ$

B. $(90 - (t + k, ))^\circ$

C. $(90 - t)^\circ$

D. $(90 + k)^\circ$

**ID: 75cef981 Answer**

Correct Answer: C

Rationale

Choice C is correct. Since $P = (4, 5)$ and $Q = (4, 7)$, side $PQ$ is parallel to the *y*-axis and has a length of $2$. Since $P = (4, 5)$ and $R = (6, 5)$, side $PR$ is parallel to the *x*-axis and has a length of $2$. Therefore, triangle $PQR$ is a right isosceles triangle, where $\angle P$ has measure $90^\circ$ and $\angle Q$ and $\angle R$ each have measure $45^\circ$. It follows that if the measure of $\angle Q$ is $t^\circ$, then $t = 45$. Since $L = (4, 5)$ and $M = (4, 7 + k)$, side $LM$ is parallel to the *y*-axis and has a length of $k + 2$. Since $L = (4, 5)$ and $N = (6 + k, 5)$, side $LN$ is parallel to the *x*-axis and has a length of $k + 2$. Therefore, triangle $LMN$ is a right isosceles triangle, where $\angle L$ has measure $90^\circ$ and $\angle M$ and $\angle N$ each have measure $45^\circ$. Of the given choices, only $(90 - t)^\circ$ is equal to $45^\circ$, so the measure of $\angle N$ is $(90 - t)^\circ$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

# Question ID a445876d

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: a445876d**

Triangle $XYZ$ is similar to triangle $RST$ such that $X$, $Y$, and $Z$ correspond to $R$, $S$, and $T$, respectively. The measure of $\angle Z$ is $20^\circ$ and $2XY = RS$. What is the measure of $\angle T$?

A. $2^\circ$

B. $10^\circ$

C. $20^\circ$

D. $40^\circ$

**ID: a445876d Answer**

Correct Answer: C

Rationale

Choice C is correct. It's given that triangle $XYZ$ is similar to triangle $RST$, such that $X$, $Y$, and $Z$ correspond to $R$, $S$, and $T$, respectively. Since corresponding angles of similar triangles are congruent, it follows that the measure of $\angle Z$ is congruent to the measure of $\angle T$. It's given that the measure of $\angle Z$ is $20^\circ$. Therefore, the measure of $\angle T$ is $20^\circ$.

Choice A is incorrect and may result from a conceptual error.

Choice B is incorrect. This is half the measure of $\angle Z$.

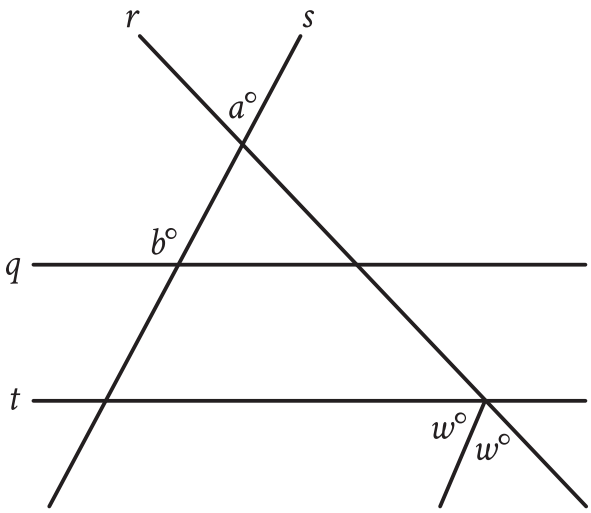
Choice D is incorrect. This is twice the measure of $\angle Z$.

Question Difficulty: Hard

# Question ID 9a3b790e

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 9a3b790e**




Note: Figure not drawn to scale.

In the figure, parallel lines $q$ and $t$ are intersected by lines $r$ and $s$. If $a = 43$ and $b = 122$, what is the value of $w$?

**ID: 9a3b790e Answer**

Correct Answer: 101/2, 50.5

Rationale

The correct answer is $\frac{101}{2}$. In the figure, lines $q$, $r$, and $s$ form a triangle. One interior angle of this triangle is vertical to the angle marked $a^\circ$; therefore, the interior angle also has measure $a^\circ$. It's given that $a = 43$. Therefore, the interior angle of the triangle has measure $43^\circ$. A second interior angle of the triangle forms a straight line, $q$, with the angle marked $b^\circ$. Therefore, the sum of the measures of these two angles is $180^\circ$. It's given that $b = 122$. Therefore, the angle marked $b^\circ$ has measure $122^\circ$ and the second interior angle of the triangle has measure $(180 - 122)^\circ$, or $58^\circ$. The sum of the interior angles of a triangle is $180^\circ$. Therefore, the measure of the third interior angle of the triangle is $(180 - 43 - 58)^\circ$, or $79^\circ$. It's given that parallel lines $q$ and $t$ are intersected by line $r$. It follows that the triangle's interior angle with measure $79^\circ$ is congruent to the same side interior angle between lines $q$ and $t$ formed by lines $t$ and $r$. Since this angle is supplementary to the two angles marked $w^\circ$, the sum of $79^\circ$, $w^\circ$, and $w^\circ$ is $180^\circ$. It follows that $79 + w + w = 180$, or $79 + 2w = 180$. Subtracting $79$ from both sides of this equation yields $2w = 101$. Dividing both sides of this equation by $2$ yields $w = \frac{101}{2}$. Note that 101/2 and 50.5 are examples of ways to enter a correct answer.

Question Difficulty: Hard

# Question ID d3151792

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: d3151792**

A line intersects two parallel lines, forming four acute angles and four obtuse angles. The measure of one of these eight angles is $(7x - 250)^\circ$. The sum of the measures of four of the eight angles is $k^\circ$. Which of the following could NOT be equivalent to $k$, for all values of $x$?

A. $-14x + 1{,}540$

B. $14x - 320$

C. $-28x + 1{,}720$

D. $360$

**ID: d3151792 Answer**

Correct Answer: A

Rationale

Choice A is correct. It's given that a line intersects two parallel lines, forming four acute angles and four obtuse angles. Since there are two parallel lines intersected by a transversal, all four acute angles have the same measure and all four obtuse angles have the same measure. Additionally, each acute angle is supplementary to each obtuse angle. It's given that the measure of one of these eight angles is $(7x - 250)^\circ$. It follows that a supplementary angle has measure $(180 - (7x - 250))^\circ$, or $(-7x + 430)^\circ$. It's also given that the sum of the measures of four of the eight angles is $k^\circ$. It follows that the possible values of $k$ are $4(7x - 250)$; $(7x - 250) + 3(-7x + 430)$; $2(7x - 250) + 2(-7x + 430)$; $3(7x - 250) + (-7x + 430)$; and $4(-7x + 430)$. These values are equivalent to $28x - 1{,}000$; $-14x + 1{,}040$; $360$; $14x - 320$; and $-28x + 1{,}720$, respectively. It follows that of the given choices, only $-14x + 1{,}540$ could NOT be equivalent to $k$, for all values of $x$.

Choice B is incorrect. This is the sum of three angles with measure $(7x - 250)^\circ$ and one angle with measure $(-7x + 430)^\circ$.

Choice C is incorrect. This is the sum of four angles with measure $(-7x + 430)^\circ$.

Choice D is incorrect. This is the sum of two angles with measure $(7x - 250)^\circ$ and two angles with measure $(-7x + 430)^\circ$.

Question Difficulty: Hard

# Question ID 01cec512

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 01cec512**

A line intersects two parallel lines, forming four acute angles and four obtuse angles. The measure of one of the acute angles is $(9x - 560)^\circ$. The sum of the measures of one of the acute angles and three of the obtuse angles is $(-18x + w)^\circ$. What is the value of $w$?

**ID: 01cec512 Answer**

Correct Answer: 1660

Rationale

The correct answer is $1{,}660$. It's given that a line intersects two parallel lines, forming four acute angles and four obtuse angles. When two parallel lines are intersected by a transversal line, the angles formed have the following properties: two adjacent angles are supplementary, and alternate interior angles are congruent. Therefore, each of the four acute angles have the same measure, and each of the four obtuse angles have the same measure. It's also given that the measure of one of the acute angles is $(9x - 560)^\circ$. If two angles are supplementary, then the sum of their measures is $180^\circ$. Therefore, the measure of the obtuse angle adjacent to any of the acute angles is $(180 - (9x - 560))^\circ$, or $(180 - 9x + 560)^\circ$, which is equivalent to $(-9x + 740)^\circ$. It's given that the sum of the measures of one of the acute angles and three of the obtuse angles is $(-18x + w)^\circ$. It follows that $(9x - 560) + 3(-9x + 740) = (-18x + w)$, which is equivalent to $9x - 560 - 27x + 2{,}220 = -18x + w$, or $-18x + 1{,}660 = -18x + w$. Adding $18x$ to both sides of this equation yields $1{,}660 = w$.

Question Difficulty: Hard

# Question ID c6f2e3c2

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: c6f2e3c2**

In right triangle $ABC$, angle $C$ is the right angle and $BC = 162$. Point $D$ on side $AB$ is connected by a line segment with point $E$ on side $AC$ such that line segment $DE$ is parallel to side $BC$ and $CE = 2AE$. What is the length of line segment $DE$?

**ID: c6f2e3c2 Answer**

Correct Answer: 54

Rationale

The correct answer is $54$. It's given that in triangle $ABC$, point $D$ on side $AB$ is connected by a line segment with point $E$ on side $AC$ such that line segment $DE$ is parallel to side $BC$. It follows that parallel segments $DE$ and $BC$ are intersected by sides $AB$ and $AC$. If two parallel segments are intersected by a third segment, corresponding angles are congruent. Thus, corresponding angles $C$ and $AED$ are congruent and corresponding angles $B$ and $ADE$ are congruent. Since triangle $ADE$ has two angles that are each congruent to an angle in triangle $ABC$, triangle $ADE$ is similar to triangle $ABC$ by the angle-angle similarity postulate, where side $DE$ corresponds to side $BC$, and side $AE$ corresponds to side $AC$. Since the lengths of corresponding sides in similar triangles are proportional, it follows that $\frac{DE}{BC} = \frac{AE}{AC}$. Since point $E$ lies on side $AC$, $AE + CE = AC$. It's given that $CE = 2AE$. Substituting $2AE$ for $CE$ in the equation $AE + CE = AC$ yields $AE + 2AE = AC$, or $3AE = AC$. It's given that $BC = 162$. Substituting $162$ for $BC$ and $3AE$ for $AC$ in the equation $\frac{DE}{BC} = \frac{AE}{AC}$ yields $\frac{DE}{162} = \frac{AE}{3AE}$, or $\frac{DE}{162} = \frac{1}{3}$. Multiplying both sides of this equation by $162$ yields $DE = 54$. Thus, the length of line segment $DE$ is $54$.

Question Difficulty: Hard

# Question ID edf2d791

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

## ID: edf2d791

In triangles $ABC$ and $DEF$, angles $B$ and $E$ each have measure $27^\circ$ and angles $C$ and $F$ each have measure $41^\circ$. Which additional piece of information is sufficient to determine whether triangle $ABC$ is congruent to triangle $DEF$?

A. The measure of angle $A$

B. The length of side $AB$

C. The lengths of sides $BC$ and $EF$

D. No additional information is necessary.

## ID: edf2d791 Answer

Correct Answer: C

Rationale

Choice C is correct. Since angles $B$ and $E$ each have the same measure and angles $C$ and $F$ each have the same measure, triangles $ABC$ and $DEF$ are similar, where side $BC$ corresponds to side $EF$. To determine whether two similar triangles are congruent, it is sufficient to determine whether one pair of corresponding sides are congruent. Therefore, to determine whether triangles $ABC$ and $DEF$ are congruent, it is sufficient to determine whether sides $BC$ and $EF$ have equal length. Thus, the lengths of $BC$ and $EF$ are sufficient to determine whether triangle $ABC$ is congruent to triangle $DEF$.

Choice A is incorrect and may result from conceptual errors.

Choice B is incorrect and may result from conceptual errors.

Choice D is incorrect. The given information is sufficient to determine that triangles $ABC$ and $DEF$ are similar, but not whether they are congruent.

Question Difficulty: Hard

# Question ID aac770b4

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

## ID: aac770b4

In triangles $LMN$ and $RST$, angles $L$ and $R$ each have measure $60^\circ$, $LN = 10$, and $RT = 30$. Which additional piece of information is sufficient to prove that triangle $LMN$ is similar to triangle $RST$?

A. $MN = 7$ and $ST = 7$

B. $MN = 7$ and $ST = 21$

C. The measures of angles $M$ and $S$ are $70^\circ$ and $60^\circ$, respectively.

D. The measures of angles $M$ and $T$ are $70^\circ$ and $50^\circ$, respectively.

## ID: aac770b4 Answer

Correct Answer: D

Rationale

Choice D is correct. Two triangles are similar if they have three pairs of congruent corresponding angles. It's given that angles $L$ and $R$ each measure $60^\circ$, and so these corresponding angles are congruent. If angle $M$ is $70^\circ$, then angle $N$ must be $50^\circ$ so that the sum of the angles in triangle $LMN$ is $180^\circ$. If angle $T$ is $50^\circ$, then angle $S$ must be $70^\circ$ so that the sum of the angles in triangle $RST$ is $180^\circ$. Therefore, if the measures of angles $M$ and $T$ are $70^\circ$ and $50^\circ$, respectively, then corresponding angles $M$ and $S$ are both $70^\circ$, and corresponding angles $N$ and $T$ are both $50^\circ$. It follows that triangles $LMN$ and $RST$ have three pairs of congruent corresponding angles, and so the triangles are similar. Therefore, the additional piece of information that is sufficient to prove that triangle $LMN$ is similar to triangle $RST$ is that the measures of angles $M$ and $T$ are $70^\circ$ and $50^\circ$, respectively.

Choice A is incorrect. If the measures of two sides in one triangle are proportional to the corresponding sides in another triangle and the included angles are congruent, then the triangles are similar. However, the two sides given are not proportional and the angle given is not included by the given sides.

Choice B is incorrect. If the measures of two sides in one triangle are proportional to the corresponding sides in another triangle and the included angles are congruent, then the triangles are similar. However, the angle given is not included between the proportional sides.

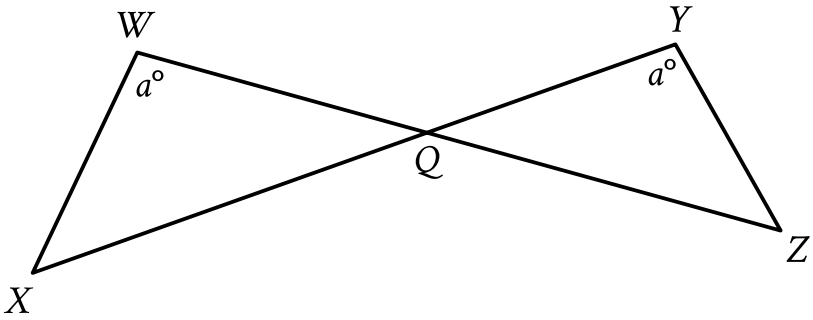
Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

# Question ID 082dcfa7

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 082dcfa7**




Note: Figure not drawn to scale.

In the figure shown, $\overline{WZ}$ and $\overline{XY}$ intersect at point $Q$. $YQ = 63$, $WQ = 70$, $WX = 60$, and $XQ = 120$. What is the length of $\overline{YZ}$?

**ID: 082dcfa7 Answer**

Correct Answer: 54

Rationale

The correct answer is $54$. The figure shown includes two triangles, triangle $WQX$ and triangle $YQZ$, such that angle $WQX$ and angle $YQZ$ are vertical angles. It follows that angle $WQX$ is congruent to angle $YQZ$. It's also given in the figure that the measures of angle $W$ and angle $Y$ are $a^\circ$. Therefore angle $W$ is congruent to angle $Y$. Since triangle $WQX$ and triangle $YQZ$ have two pairs of congruent angles, triangle $WQX$ is similar to triangle $YQZ$ by the angle-angle similarity postulate, where $\overline{YZ}$ corresponds to $\overline{WX}$, and $\overline{YQ}$ corresponds to $\overline{WQ}$. Since the lengths of corresponding sides in similar triangles are proportional, it follows that $\frac{YZ}{WX} = \frac{YQ}{WQ}$. It's given that $YQ = 63$, $WQ = 70$, and $WX = 60$. Substituting $63$ for $YQ$, $70$ for $WQ$, and $60$ for $WX$ in the equation $\frac{YZ}{WX} = \frac{YQ}{WQ}$ yields $\frac{YZ}{60} = \frac{63}{70}$. Multiplying each side of this equation by $60$ yields $YZ = \left(\frac{63}{70}\right)(60)$, or $YZ = 54$. Therefore, the length of $\overline{YZ}$ is $54$.

Question Difficulty: Hard

# Question ID 3dd4aa7b

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

## ID: 3dd4aa7b

In triangle $XYZ$, angle $Y$ is a right angle, point $P$ lies on $\overline{XZ}$, and point $Q$ lies on $\overline{YZ}$ such that $\overline{PQ}$ is parallel to $\overline{XY}$. If the measure of angle $XZY$ is $63^\circ$, what is the measure, in degrees, of angle $XPQ$?

## ID: 3dd4aa7b Answer

Correct Answer: 153

Rationale

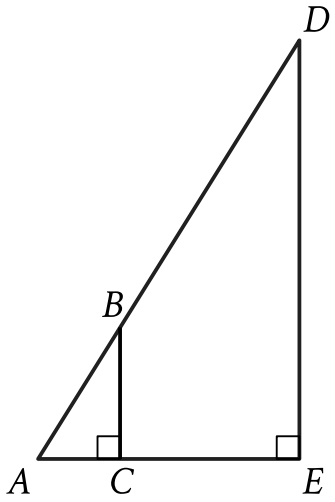
The correct answer is $153$. Since it's given that $\overline{PQ}$ is parallel to $\overline{XY}$ and angle $Y$ is a right angle, angle $ZQP$ is also a right angle. Angle $ZPQ$ is complementary to angle $XZY$, which means its measure, in degrees, is $90 - 63$, or $27$. Since angle $XPQ$ is supplementary to angle $ZPQ$, its measure, in degrees, is $180 - 27$, or $153$.

Question Difficulty: Hard

# Question ID 2b1b9792

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 2b1b9792**




Note: Figure not drawn to scale.

In the figure shown, $AB = \sqrt{34}$ units, $AC = 3$ units, and $CE = 21$ units. What is the area, in square units, of triangle $ADE$?

**ID: 2b1b9792 Answer**

Correct Answer: 480

Rationale

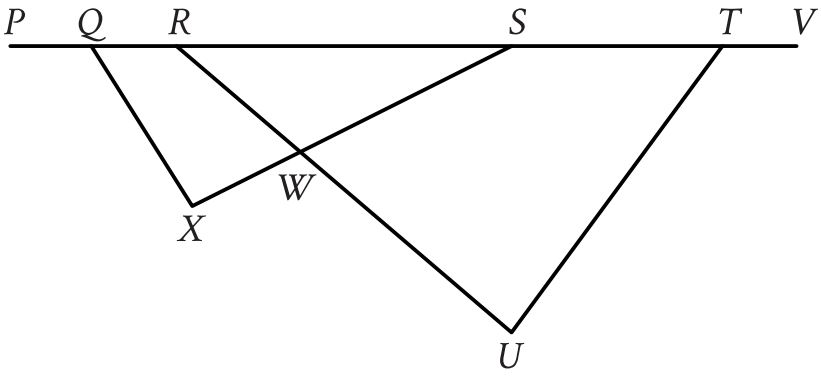
The correct answer is $480$. It's given in the figure that angle $ACB$ and angle $AED$ are right angles. It follows that angle $ACB$ is congruent to angle $AED$. It's also given that angle $BAC$ and angle $DAE$ are the same angle. It follows that angle $BAC$ is congruent to angle $DAE$. Since triangles $ABC$ and $ADE$ have two pairs of congruent angles, the triangles are similar. Sides $AB$ and $AC$ in triangle $ABC$ correspond to sides $AD$ and $AE$, respectively, in triangle $ADE$. Corresponding sides in similar triangles are proportional. Therefore, $\frac{AD}{AB} = \frac{AE}{AC}$. It's given that $AC = 3$ units and $CE = 21$ units. Therefore, $AE = 24$ units. It's also given that $AB = \sqrt{34}$ units. Substituting $3$ for $AC$, $24$ for $AE$, and $\sqrt{34}$ for $AB$ in the equation $\frac{AD}{AB} = \frac{AE}{AC}$ yields $\frac{AD}{\sqrt{34}} = \frac{24}{3}$, or $\frac{AD}{\sqrt{34}} = 8$. Multiplying each side of this equation by $\sqrt{34}$ yields $AD = 8\sqrt{34}$. By the Pythagorean theorem, if a right triangle has a hypotenuse with length $c$ and legs with lengths $a$ and $b$, then $a^2 + b^2 = c^2$. Since triangle $ADE$ is a right triangle, it follows that $AD$ represents the length of the hypotenuse, $c$, and $DE$ and $AE$ represent the lengths of the legs, $a$ and $b$. Substituting $24$ for $b$ and $8\sqrt{34}$ for $c$ in the equation $a^2 + b^2 = c^2$ yields $a^2 + (24)^2 = \left(8\sqrt{34}\right)^2$, which is equivalent to $a^2 + 576 = 64(34)$, or $a^2 + 576 = 2{,}176$. Subtracting $576$ from both sides of this equation yields $a^2 = 1{,}600$. Taking the square root of both sides of this equation yields $a = \pm 40$. Since $a$ represents a length, which must be positive, the value of $a$ is $40$. Therefore, $DE = 40$. Since $DE$ and $AE$ represent the lengths of the legs of triangle $ADE$, it follows that $DE$ and $AE$ can be used to calculate the area, in square units, of the triangle as $\frac{1}{2}(40)(24)$, or $480$. Therefore, the area, in square units, of triangle $ADE$ is $480$.

Question Difficulty: Hard

# Question ID 034aa7ae

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 034aa7ae**




Note: Figure not drawn to scale.

In the figure shown, points $Q$, $R$, $S$, and $T$ lie on line segment $PV$, and line segment $RU$ intersects line segment $SX$ at point $W$. The measure of $\angle SQX$ is $48^\circ$, the measure of $\angle SXQ$ is $86^\circ$, the measure of $\angle SWU$ is $85^\circ$, and the measure of $\angle VTU$ is $162^\circ$. What is the measure, in degrees, of $\angle TUR$?

**ID: 034aa7ae Answer**

Correct Answer: 123

Rationale

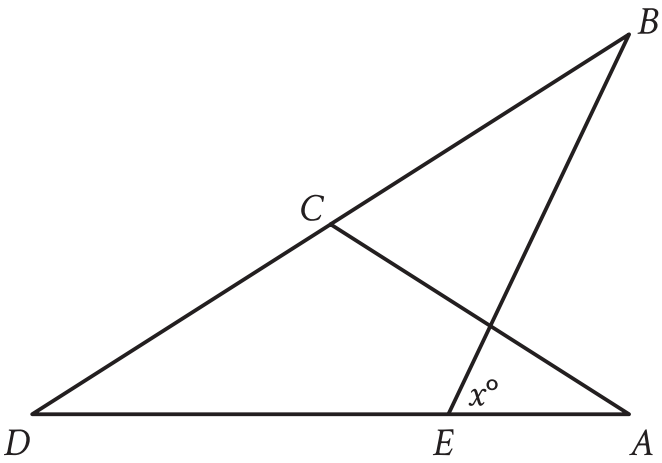
The correct answer is $123$. The triangle angle sum theorem states that the sum of the measures of the interior angles of a triangle is $180$ degrees. It's given that the measure of $\angle SQX$ is $48^\circ$ and the measure of $\angle SXQ$ is $86^\circ$. Since points $S$, $Q$, and $X$ form a triangle, it follows from the triangle angle sum theorem that the measure, in degrees, of $\angle QSX$ is $180 - 48 - 86$, or $46$. It's also given that the measure of $\angle SWU$ is $85^\circ$. Since $\angle SWU$ and $\angle SWR$ are supplementary angles, the sum of their measures is $180$ degrees. It follows that the measure, in degrees, of $\angle SWR$ is $180 - 85$, or $95$. Since points $R$, $S$, and $W$ form a triangle, and $\angle RSW$ is the same angle as $\angle QSX$, it follows from the triangle angle sum theorem that the measure, in degrees, of $\angle WRS$ is $180 - 46 - 95$, or $39$. It's given that the measure of $\angle VTU$ is $162^\circ$. Since $\angle VTU$ and $\angle STU$ are supplementary angles, the sum of their measures is $180$ degrees. It follows that the measure, in degrees, of $\angle STU$ is $180 - 162$, or $18$. Since points $R$, $T$, and $U$ form a triangle, and $\angle URT$ is the same angle as $\angle WRS$, it follows from the triangle angle sum theorem that the measure, in degrees, of $\angle TUR$ is $180 - 39 - 18$, or $123$.

Question Difficulty: Hard

# Question ID b7222daa

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: b7222daa**




Note: Figure not drawn to scale.

In the figure, $AC = CD$. The measure of angle $EBC$ is $45^\circ$, and the measure of angle $ACD$ is $104^\circ$. What is the value of $x$?

**ID: b7222daa Answer**

Correct Answer: 83

Rationale

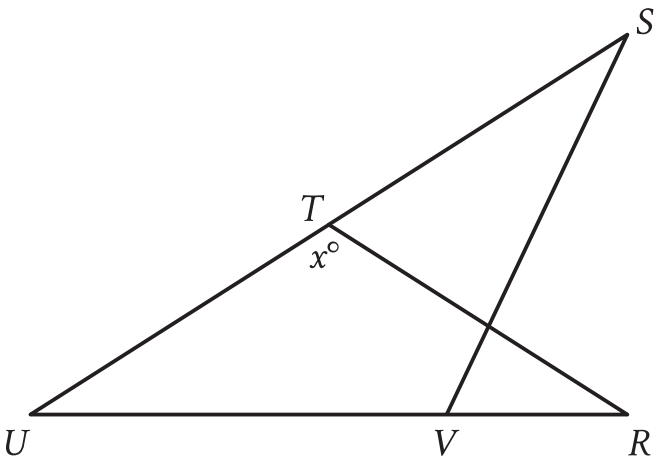
The correct answer is $83$. It's given that in the figure, $AC = CD$. Thus, triangle $ACD$ is an isosceles triangle and the measure of angle $CDA$ is equal to the measure of angle $CAD$. The sum of the measures of the interior angles of a triangle is $180^\circ$. Thus, the sum of the measures of the interior angles of triangle $ACD$ is $180^\circ$. It's given that the measure of angle $ACD$ is $104^\circ$. It follows that the sum of the measures of angles $CDA$ and $CAD$ is $(180 - 104)^\circ$, or $76^\circ$. Since the measure of angle $CDA$ is equal to the measure of angle $CAD$, the measure of angle $CDA$ is half of $76^\circ$, or $38^\circ$. The sum of the measures of the interior angles of triangle $BDE$ is $180^\circ$. It's given that the measure of angle $EBC$ is $45^\circ$. Since the measure of angle $BDE$, which is the same angle as angle $CDA$, is $38^\circ$, it follows that the measure of angle $DEB$ is $(180 - 45 - 38)^\circ$, or $97^\circ$. Since angle $DEB$ and angle $AEB$ form a straight line, the sum of the measures of these angles is $180^\circ$. It's given in the figure that the measure of angle $AEB$ is $x^\circ$. It follows that $97 + x = 180$. Subtracting $97$ from both sides of this equation yields $x = 83$.

Question Difficulty: Hard

# Question ID 794c0ca9

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 794c0ca9**




Note: Figure not drawn to scale.

In the figure, $RT = TU$, the measure of angle $VST$ is $29^\circ$, and the measure of angle $RVS$ is $41^\circ$. What is the value of $x$?

**ID: 794c0ca9 Answer**

Correct Answer: 156

Rationale

The correct answer is $156$. In the figure shown, the sum of the measures of angle $UVS$ and angle $RVS$ is $180^\circ$. It's given that the measure of angle $RVS$ is $41^\circ$. Therefore, the measure of angle $UVS$ is $(180 - 41)^\circ$, or $139^\circ$. The sum of the measures of the interior angles of a triangle is $180^\circ$. In triangle $UVS$, the measure of angle $UVS$ is $139^\circ$ and it's given that the measure of angle $VST$ is $29^\circ$. Thus, the measure of angle $VUS$ is $(180 - 139 - 29)^\circ$, or $12^\circ$. It's given that $RT = TU$. Therefore, triangle $TUR$ is an isosceles triangle and the measure of $VUS$ is equal to the measure of angle $TRU$. In triangle $TUR$, the measure of angle $VUS$ is $12^\circ$ and the measure of angle $TRU$ is $12^\circ$. Thus, the measure of angle $UTR$ is $(180 - 12 - 12)^\circ$, or $156^\circ$. The figure shows that the measure of angle $UTR$ is $x^\circ$, so the value of $x$ is $156$.

Question Difficulty: Hard

# Question ID 494cbff8

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| SAT | Math | Geometry and Trigonometry | Lines, angles, and triangles | Hard |

**ID: 494cbff8**

Quadrilaterals $PQRS$ and $WXYZ$ are similar, where $P$, $Q$, and $R$ correspond to $W$, $X$, and $Y$, respectively. The measure of $\angle S$ is $135^\circ$, $PS = 45$, and $WZ = 9$. What is the measure of $\angle Z$?

A. $5^\circ$

B. $27^\circ$

C. $45^\circ$

D. $135^\circ$

**ID: 494cbff8 Answer**

Correct Answer: D

Rationale

Choice D is correct. Corresponding angles in similar figures have equal measure. It's given that quadrilaterals $PQRS$ and $WXYZ$ are similar and that $P$, $Q$, and $R$ correspond to $W$, $X$, and $Y$. It follows that $\angle S$ corresponds to $\angle Z$. It's also given that the measure of $\angle S$ is $135^\circ$. Therefore, the measure of $\angle Z$ is $135^\circ$.

Choice A is incorrect and may result from conceptual errors.

Choice B is incorrect and may result from conceptual errors.

Choice C is incorrect. This is the supplement of the measure of $\angle Z$, not the measure of $\angle Z$.

Question Difficulty: Hard