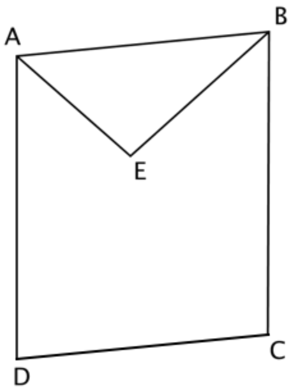
THE BEST ACT PREP COURSE EVER

ANGLES AND LINES

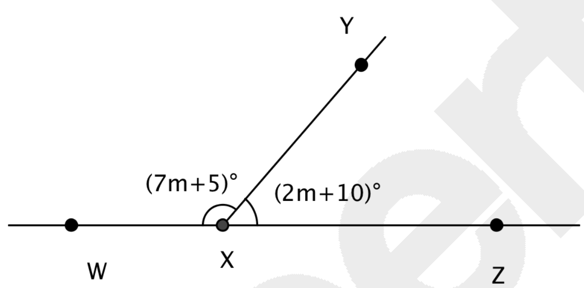
ACT Math: Problem Set

1. In the figure below, $ABCD$ is a parallelogram, $\angle DAE$ is $64°$, $\angle DCB$ is $94°$ and $\overline{BE}$ bisects $\angle ABC$. What is $\angle AEB$?



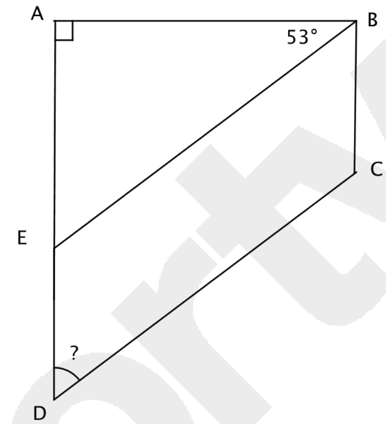
A. 103°
B. 105°
C. 107°
D. 109°
E. Cannot be determined from given information

2. In the figure below, X is on $\overline{WZ}$ and the angle measures are as given. What is the value of $3m$?



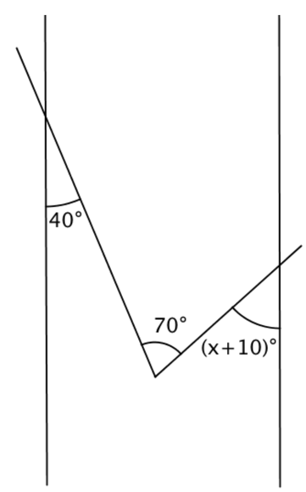
A. 20°
B. 55°
C. 45°
D. 18.33°
E. 60°

3. In the figure below, lines $\overline{AD}$ and $\overline{BC}$ are parallel, lines $\overline{EB}$ and $\overline{DC}$ are parallel, $\angle ABE$ is $53°$ and $\angle EAB$ is a right angle. What is the measure of $\angle EDC$?



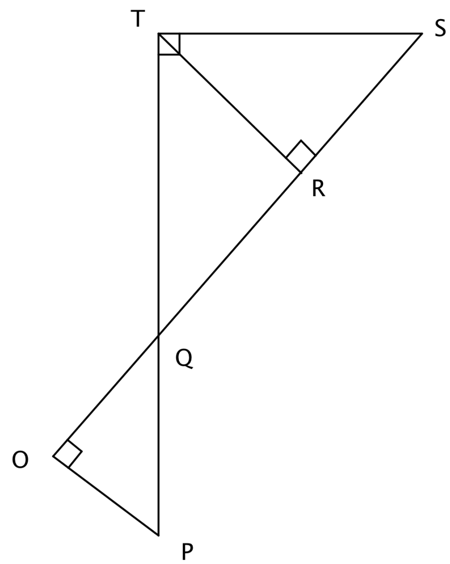
A. 26.5°
B. 37°
C. 53°
D. 127
E. 143°

4. In the figure below, the two vertical lines are parallel. What is the value of x?



A. 20
B. 30
C. 50
D. 60
E. It cannot be determined from the information provided

5. Which of the following statements regarding the figure below is false?



A. $\overline{OP} \parallel \overline{TR}$

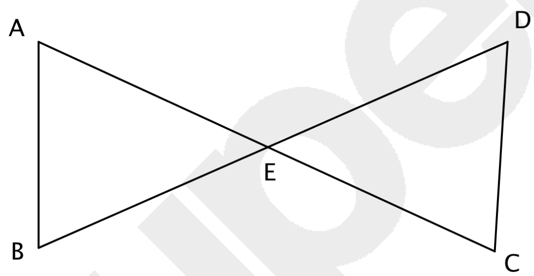
B. $\overline{RS} \perp \overline{OP}$

C. $\overline{TR} = \overline{TS}$

D. $\angle OPQ = \angle QTR$

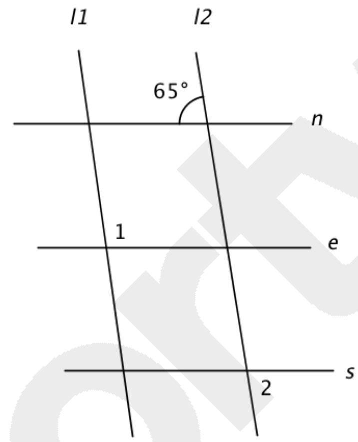
E. $QR < QT$

6. If $\angle ABE > \angle EDC$, which of the following statements is always true?



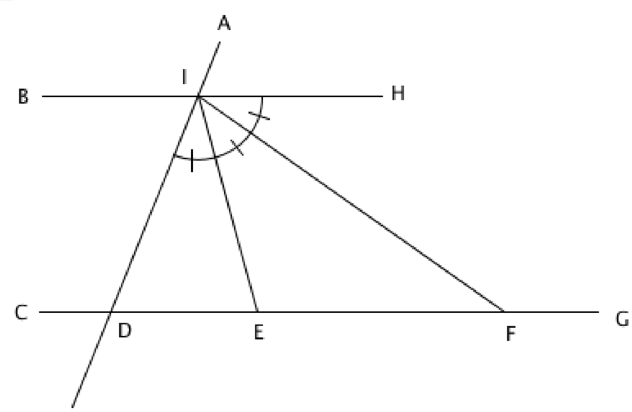
A. $\overline{AB} \parallel \overline{CD}$
B. $\angle C < \angle A$
C. $\angle A < \angle C$
D. $AE > CE$
E. $BE > ED$

7. In the figure below, parallel lines $l1$ and $l2$ intersect parallel lines n , e , and s . If it can be determined, what is the sum of the degree measures of $\angle 1$ and $\angle 2$?



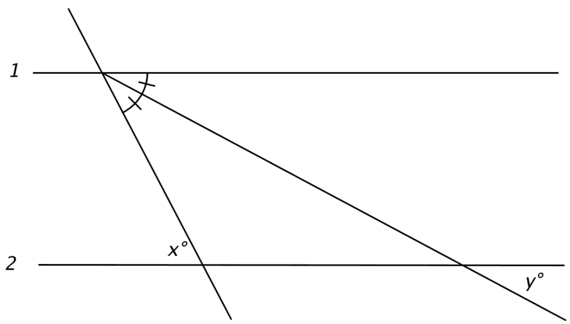
A. 65°
B. 90°
C. 180°
D. 115°
E. It cannot be determined from the information provided

8. In the figure below, $\overleftrightarrow{BH}$ is parallel to $\overleftrightarrow{CG}$, I lies on $\overleftrightarrow{AD}$ and $\overleftrightarrow{BH}$, E lies on $\overleftrightarrow{CG}$, the measure of $\angle AIB$ is 120°, and $\angle DIE \cong \angle EIF \cong \angle HIF$. What is the measure of $\angle IED$?



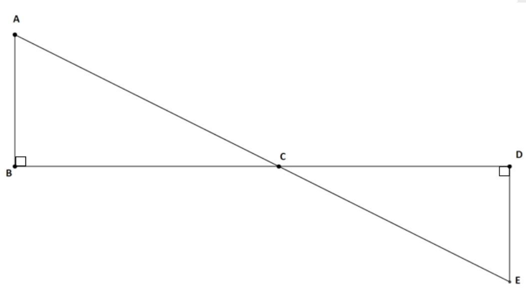
A. 20°
B. 40°
C. 50°
D. 80°
E. 100°

9. In the figure below, lines 1 and 2 are parallel. In terms of y, which of the following is equivalent to the degree measure of $\angle x$?



A. $2y$
B. $180° - y$
C. $\frac{180° - y}{2}$
D. $180° - 2y$
E. $y + 15°$

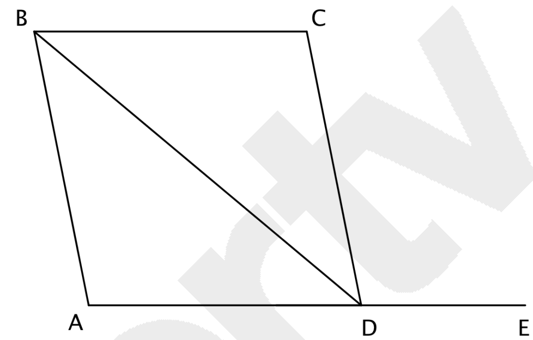
10. In the figure below, $\overline{AB}$ and $\overline{DE}$ are perpendicular to $\overline{BD}$. Which of the following statements must be true? Note: figure not drawn to scale.



I. $\overline{AB} \cong \overline{DE}$
II. $\angle ACB \cong \angle DCE$
III. ΔABC and ΔEDC are similar triangles

A. I only
B. II only
C. III only
D. I and II
E. II and III

11. In the figure below, $\overline{BD}$ is the longer diagonal of rhombus $ABCD$ and E is on $\overleftrightarrow{AD}$. The measure of $\angle ABD$ is $30°$. What is the measure of $\angle CDE$? Figure not drawn to scale.

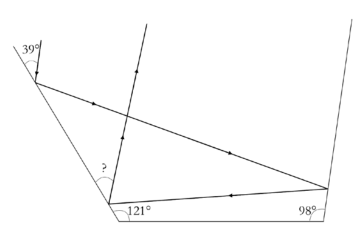


A. 60°
B. 90°
C. 105°
D. 120°
E. 160°

12. A line contains the points A, B, C, D, and E. D is to the right of A and to the left of E. B is to the right of C and to the left of D. C is to the right of A. Which of the following inequalities *must* be true about the length of these segments?

A. $AC < BD$
B. $AB > DB$
C. $AE > BE$
D. $CA > AD$
E. $CE < BD$

13. The following diagram depicts the path of a beam of light inside a modernist dance studio, where 3 of the 4 walls are mirrors. The angle at which light strikes a mirror is equal in measure to the angle at which it is reflected. What is the measure of the indicated angle?

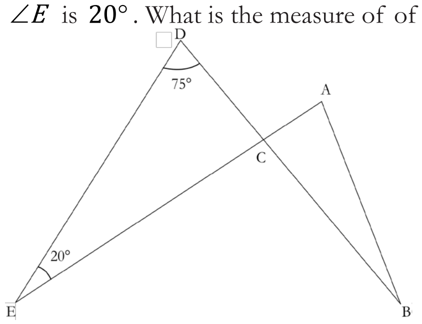


A. 32°
B. 43°
C. 50°
D. 55°
E. 69°

14. Suppose the measure of the smaller of 2 supplementary angles is a seventh of the measure of the larger angle. What is the measure of the smaller angler?

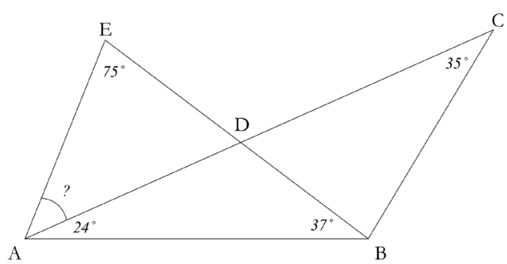
A. 19°
B. 22.5°
C. 102.5°
D. 157.5°
E. 167°

15. In the figure below $\overline{AE}$ and $\overline{BD}$ intersect at C and the measure of $\angle A$ is four times that of $\angle B$ The measure of $\angle D$ is $75°$ and the measure of $\angle E$ is $20°$. What is the measure of of $\angle A$?



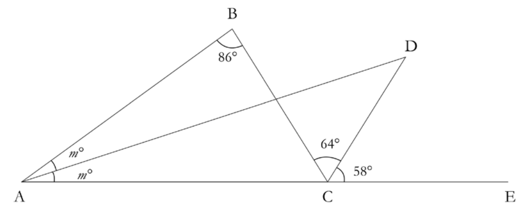
A. 19°
B. 72°
C. 76°
D. 85°
E. 95°

16. In the figure below $\overline{AC}$ and $\overline{BE}$ intersect at D. What is the measure of $\angle EAD$?



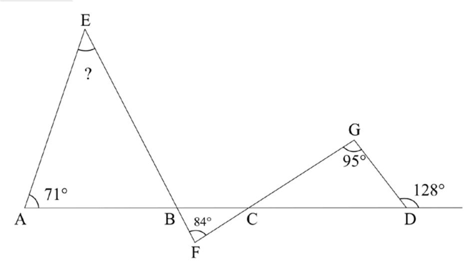
A. 24°
B. 44°
C. 61°
D. 84°
E. 119°

17. In the figure below A, C, and E are collinear. ÄABC and ÄADC are as pictured below, and the angle measures are marked. What is the value of *m*?



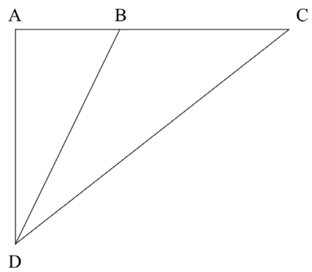
A. 18
B. 22
C. 23
D. 24
E. 36

18. In the figure below points $A, B, C,$ and D are collinear, points *E*, *B*, and *F* are collinear, and points *F*, *C*, and *G* are collinear. Angle measures are marked below. What is the measure of $\angle AEB$?



A. 33°
B. 46°
C. 52°
D. 63°
E. 84°

19. In ΔACD points A, B, and C are collinear. $\overline{AC}$ is perpendicular to $\overline{AD}$, $\overline{DB}$ bisects $\angle ADC$, and the measure of $\angle ACD$ is $38°$. What is the *sum* of $\angle ADB$ and $\angle DBC$?



A. $16°$
B. $26°$
C. $64°$
D. $116°$
E. $142°$

20. Distinct lines *l* and *m* intersect, forming 4 pairs of adjacent angles. Which of the following statement is *not* true about these 4 pairs of angles?

A. The sum of all 4 angles is equal to 360°.
B. The sum of the angle measures in each pair is 180°.
C. The difference of the angle measures in each pair is less than 180°.
D. The sum of one pair of angles is greater than sum of the other remaining pair.
E. The sum of one pair of angles is equal to 360° minus the sum of the other remaining pair.

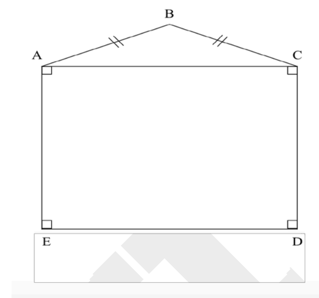
21. The expression $(180 - x)$ is the degree measure of a nonzero obtuse angle if and only if?

A. $0 < x < 45$
B. $0 < x < 90$
C. $45 < x < 90$
D. $0 < x < 180$
E. $90 < x < 180$

22. The non-common rays of 2 adjacent angles form a straight angle. The measure of one angle is one fifth the measure of the other angle. What is the measure of the smaller angle?

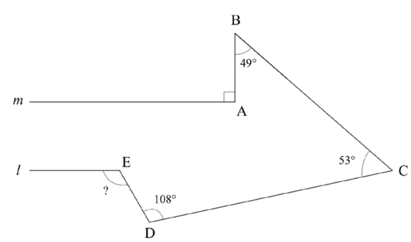
A. $7.5°$
B. $15°$
C. $30°$
D. $45°$
E. $150°$

23. In the diagram below Ä ABC, is isosceles. The measure of $\angle ABC$ is 7 times the measure of $\angle BAC$. What is the measure of $\angle ABC - \angle EAB$?



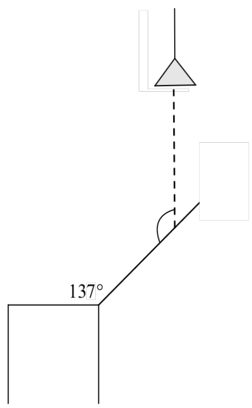
A. $10°$
B. $20°$
C. $30°$
D. $110°$
E. $140°$

24. In the figure below, lines l and m are parallel and perpendicular to line $\overline{AB}$. Point C is in line with point E and line l. If the measure of $\angle ABC$ is $49°$, the measure of $\angle BCD$ is $53°$, and the measure of $\angle EDC$ is $108°$, what is the measure of the angle that $\overline{AB}$ makes with line l?



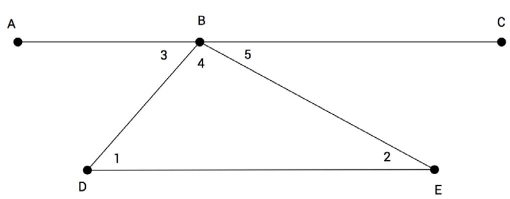
A. $41°$
B. $60°$
C. $90°$
D. $120°$
E. $132°$

25. Annie is relaxing in an armchair with the chair back reclined $137°$. Looking straight up, she realizes that there is lamp directly above her head, interfering with her rest, so she decides to move to a different armchair. Below is a sketch of the chair and the lamp. At what angle is the lamp with the back of the armchair?



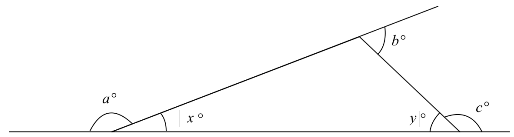
A. $47°$
B. $97°$
C. $133°$
D. $135°$
E. $137°$

26. In the figure below, B is on $\overline{AC}$ and $\overline{AC} \parallel \overline{DE}$. Which of the following angle congruences holds true?



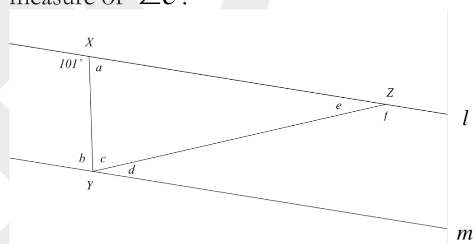
A. $\angle 2 \cong \angle 3$
B. $\angle 2 \cong \angle 4$
C. $\angle 1 \cong \angle 4$
D. $\angle 1 \cong \angle 5$
E. $\angle 1 \cong \angle 3$

27. Given the triangle shown below with exterior angles that measure $a°, b°,$ and $c°$ as shown. What is $a° - b° - c°$, in terms x of and y ?



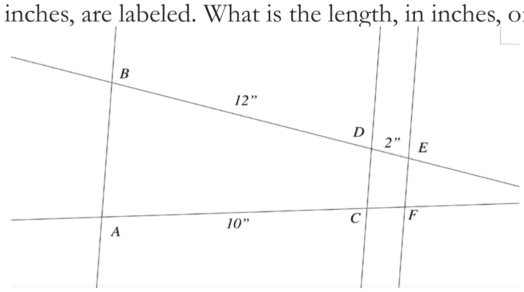
A. $2y - 2x$
B. $2x - 2y$
C. $2y + 2x$
D. $-2x$
E. $-2y$

28. In the figure below X and Z are on line l and Y is on line m. The exterior angle to at X is $101°$. Which of the following statements gives sufficient additional information to find the measure of $\angle c$?



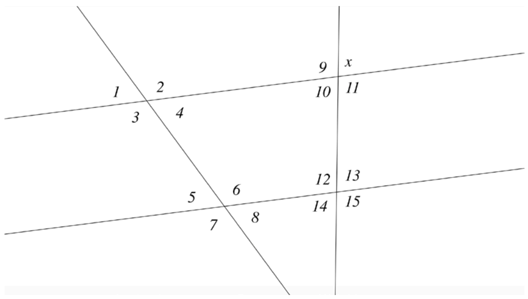
A. Line l is not parallel to line m.
B. Line l is parallel to line m.
C. The measure of $\angle e$ is equal to $\angle d$.
D. The measure of $\angle f$ is $158°$.
E. The measure of $\angle d$ is $29°$.

29. In the figure below, 3 parallel lines are crossed by two transversals. The points of intersection and some distances, in inches, are labeled. What is the length, in inches, of $\overline{CF}$?



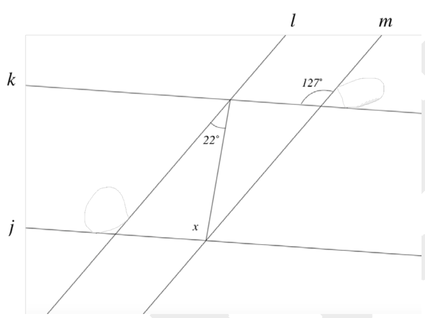
A. 1
B. 2
C. $\frac{3}{2}$
D. $\frac{5}{3}$
E. $\frac{5}{2}$

30. Lines a, b, c, and d are shown below and c||d. Which of the following is the set of angles that must be supplementary to $\angle x$?



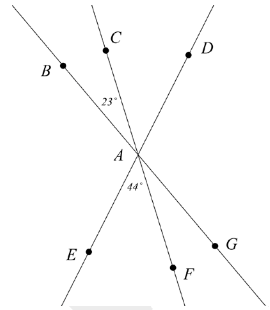
A. $\{9,11\}$
B. $\{1,4,9,11\}$
C. $\{9,10,12,14\}$
D. $\{9,11,12,15\}$
E. $\{9,10,11,12,14,15\}$

31. In the figure below, lines j and k are parallel, and lines l and m are parallel. Given the measure of two angles as shown below, what is the measure of $\angle x$?



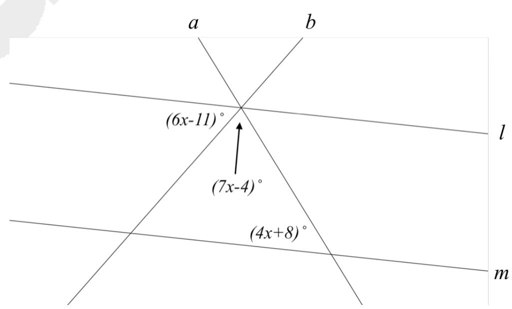
A. 53°
B. 88°
C. 90°
D. 95°
E. 105°

32. In the figure below, $\overline{BG}$, $\overline{CF}$, and $\overline{DE}$ all intersect at point A. The measure of 2 angles are given. What is the measure of $\angle DAF$?



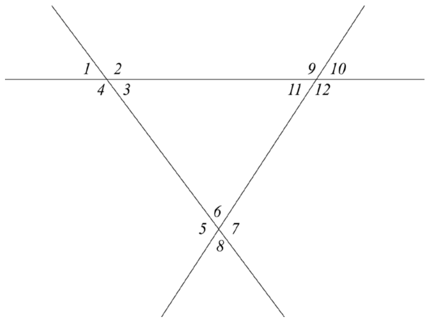
A. 67°
B. 111°
C. 134°
D. 136°
E. 157°

33. In the figure below, lines l and m are parallel. Lines a and b intersect l at the same point. What is the value of x ?



A. 7
B. 11
C. 52
D. 55
E. 73

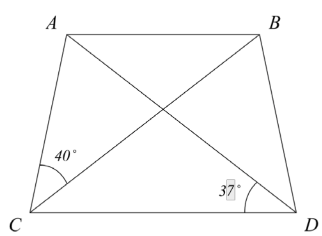
34. Each of **3** lines crosses the other 2 lines, as shoun below. Which of the following relationships, involving angle measures (in degrees), must be true?



I. $m\angle 1 + m\angle 10 + m\angle 6 = 180^\circ$
II. $m\angle 3 + m\angle 11 + m\angle 6 = 180^\circ$
III. $m\angle 8 + m\angle 11 + m\angle 3 = 180^\circ$

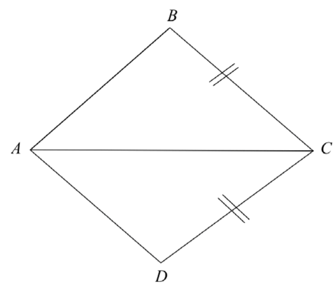
A. I only
B. II only
C. III only
D. I and II only
E. I, II, and III

35. In isosceles trapezoid $ABCD$, AB is parallel to $\overline{CD}$ $\angle ACB$ measures 40°, and $\angle ADC$ measures 38° . What is the measure of $\angle CAD$?



A. 50°
B. 66°
C. 77°
D. 88°
E. 114°

36. In the figure below, the measure of $\angle BCA$ is greater than the measure of $\angle DCA$ and $BC = DC$. Which of the following statements must be true?



A. $BC < CD$
B. $AB > BC$
C. $AB > AD$
D. $AD > CD$
E. $AB = AD$

37. In any parallelogram **ABC**, it is always true that the measures of $\angle BCD$ and $\angle CDA$:

A. Are congruent.
B. Are each 90°.
C. Ar e each less than 90°.
D. Add up to 90°.
E. Add up to 180°.

ANSWERS

1.C	**2.**B	**3.**B	**4.**A	**5.**C	**6.**E	**7.**D	**8.**D	**9.**A	**10.**E	**11.**D	**12.**C	**13.**B	**14.**B
15.C	**16.**B	**17.**A	**18.**B	**19.**E	**20.**D	**21.**B	**22.**C	**23.**C	**24.**D	**25.**C	**26.**E	**27.**D	**28.**D
29.D	**30.**D	**31.**E	**32.**D	**33.**B	**34.**E	**35.**D	**36.**C	**37.**E					

ANSWER EXPLANATIONS

1. **C.** Since $ABCD$ is a parallelogram, $\angle DAB$ is congruent to $\angle DCB$, so $\angle DAB = 94°$. We can subtract $\angle DAE(64°)$ from $\angle DAB(94°)$ to find the measure of $\angle EAB$, which we find to be $30°$. Since $\overline{AB} \parallel \overline{DC}$, $\angle ABC$ is supplementary to $\angle DCB$, thus $\angle ABC$ is $86°$. Since $\overline{BE}$ bisects $\angle ABC$, $\angle ABE = 43°$. Since all of the interior angles of a triangle sum to $180°$, $\angle EAB + \angle ABE + \angle AEB = 180°$. By substitution, $30° + 43° + \angle AEB = 180°$. Simplification shows $\angle AEB = 107°$.

2. **B.** The **2** angles shown are supplementary, since they form a straight line. Thus, $(7m+5)+(2m+10)=180$. Simplification yields $9m+15=180$. From there, solve for m to find $m = 18.\overline{333}$, and $3m = 55$.

3. **B.** By parallel lines theorem, $\angle EDC \cong \angle AEB$. Because a triangle's angles must add up to $180°$, we know that $\angle AEB$ measures $180° - \angle EAB - \angle ABE$. By substitution, this becomes $180° - 90° - 53° = 37°$. Thus, $\angle EDC = 37°$.

4. **A.** By extending either of the lines and using the parallel lines theorem, we form a triangle made up of a $40°$ angle, the $(x+10)°$ angle, and an angle supplementary to $70°$, which is $110°$. Since the sum of these 3 angles must be $180°$, we can simplify this to $x° + 160° = 180°$. Thus, $x = 20$.

5. **C.** $\overline{TR} = \overline{TS}$ because $\overline{TR}$ is a leg of right-triangle $\triangle TRS$ and $\overline{TS}$ is its hypotenuse. The leg of a right triangle cannot be equal to its hypotenuse.

6. **C.** Since the sum of the interior angles of a triangle is $180°$, arithmetic shows that any angle in a triangle is equal to $180°$ minus the other two angles. Thus, $\angle ABE = 180° - \angle A - \angle AEB$ and $\angle EDC = 180° - \angle C - \angle DEC$. $\angle AEB \cong \angle DEC$ by the vertical angles theorem. We can substitute these expressions into $\angle ABE > \angle EDC$ to get $180° - \angle A - \angle AEB > 180° - \angle C - \angle AEB$. We can simplify to get $-\angle A > -\angle C$. Dividing by a negative number, in this case **-1**, switches the direction of the comparison, so this becomes $\angle A < \angle C$.

7. **D.** Due to the parallel lines, every quadrilateral formed in the diagram is a parallelogram. We can show that $\angle 2$ is the angle in the parallelogram adjacent to $\angle 1$ by using the vertical angles theorem and the parallel lines theorem. Adjacent angles in a parallelogram are supplementary, thus $\angle 1$ and $\angle 2$ sum to $180°$.

8. **D.** $\angle AIB \cong \angle HID$ by vertical angles theorem. $\angle EID$ is one third of $\angle HID$, as shown in the diagram. Thus, $\angle EID$ is one third of $120°$, making it $40°$. $\angle IDE$ is supplementary to $\angle AIB$ by vertical lines theorem, thus $\angle IDE = 180° - \angle AIB = 180° - 120° = 60°$. Since the sum of the interior angles of a triangle is $180°$, $\angle IED + \angle IDE + \angle EID = 180°$. Substitution renders $\angle IED + 60° + 40° = 180°$. Simplification shows $\angle IED = 80°$.

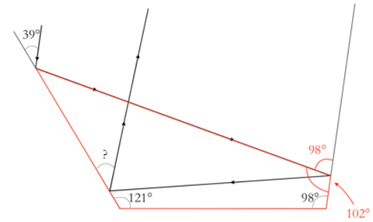
9. **A.** The parallel lines theorem shows that $\angle y$ is congruent to one of the two congruent angles in the upper-left corner of the diagram, thus the angle formed by the combined congruent angles is equal to $2y$. By the parallel lines theorem, $\angle x$ is equal to the angle formed by the combined congruent angles. Thus, $\angle x$ is equal to $2y$.

10. **E.** Angles $\angle ACB$ and $\angle DCE$ are congruent because of the Vertical Angles theorem, so II is true. These angles are congruent and $\angle B$ and $\angle E$ are both $90°$ angles. If you take the triangular sum to find angles $\angle A$ and $\angle E$, you see that they are equivalent, congruent, as well. Because all three angles are congruent, $\triangle ABC$ and $\triangle EDC$ are similar triangles, making III true. The only answer that includes both II and III is answer E.

11. **D.** Since the diagonal of a rhombus bisects the angle it is drawn from, $\angle ABC = 2\angle ABD = 2(30°) = 60°$. Since the opposite angles of a rhombus are congruent, $\angle ADC = 60°$. Since $\angle ADC$ and $\angle CDE$ form a straight line, they are supplementary, thus $\angle ADC + \angle CDE = 180°$. Substitution and simplification yields $\angle CDE = 120°$.

12. **C**. Drawing a diagram, the first fact, "D is to the right of A and to the left of E" gives us: $A \quad D \quad E$. The second fact, "B is to the right of C and to the left of D" means that $A, B,$ and C can be ordered as $ACB, CAB,$ or CBA to the left of D. The third fact, "C is to the right of A" tells us that they must be ordered ACB. Thus, the final order is $A\,C\,B\,D\,E$. Now we can look at the answers and tell that the only one that *must* be true is (C), $AE > BE$, since $AE = AB + BE$, AE must necessarily be greater than BE.

13. **B.** When the light first bounces off a mirror at $39°$, because the exact degree is reflected, a quadrilateral is formed with inside corners of the studio, with the angles $39°$, $98°$, $121°$, and an unknown angle we can solve for.



Because a quadrilateral's interior angles always equal 360°, the unknown angle is equal to $360° - 39° - 121° - 98° = 102°$ This angle we just found is supplementary to the next angle that the light is reflected at: $180° - 102° = 98°$. This second angle that is reflected, in turn, forms a smaller quadrilateral that lies entirely inside the larger one we just looked at, and this smaller quadrilateral's angles are $98°$, $121°$, $98°$, and an unknown angle. Solving for the unknown angle we get $360° - 98° - 121° - 98° = 43°$. The angle we just found, $43°$, when reflected is exactly the angle we are told to find, so our answer is $43°$.

14. **B.** This problem is tricky because of the phrasing, but we can translate the verbal expression into an equation. Two supplementary angles means that the two angles summed equal $180°$, and one of the angles is a seventh of the other, so $\frac{x}{7} + x = 180$. Solving this basic linear equation we get $\frac{8x}{7} = 180 \rightarrow x = 157.5$. This is our larger angle though, and we want the smaller one, so we can divide that by 7 or just subtract that number from $180°$ (which is much easier) to get $22.5°$.

15. **C.** Through the Triangle sum theorem (all of the angles in a triangle sum to $180°$) and the opposite angles theorem, we find that $\angle DCE$ and $\angle ACB$ both equal $85°$. So for triangle ÄABC, $\angle A + \angle B + 85° = 180°$. If we let $\angle A = 4x$ and $\angle B = x$, as the problem tells us, our equation becomes $4x + x + 85° = 180°$. When we solve for x, we find that $x = 19°$. However, we want $\angle A$, not $\angle B$, so we multiply that by **4** to get our final answer, $76°$.

16. **C.** We find $\angle EAD$ through the Triangle Sum Theorem. Looking at ÄAEB, we know that our $\angle ABE = 37^{\circ}$, $\angle E = 75^{\circ}$, and $\angle EAD = \angle DAB + 24^{\circ}$. Thus, $\angle EAD = 180^{\circ} - 24^{\circ} - 75^{\circ} - 37^{\circ} = 44^{\circ}$.

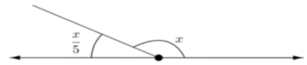
17. **A.** You could solve this the long way, first finding $\angle BCA$ because it intersects with $\angle DCE$ and $\angle BCD$ at the same point on a line so the sum of the three angles is $180°$, and then using the Triangle Sum theorem. *Or*, you could use the Exterior angle theorem, which states that the exterior angle (which is formed whenever one of the triangle's legs is extended) is equal to the sum of the other two angles. Applying this theorem to ÄABC, we get: $m° + m° + 86° = 64° + 58° \rightarrow 2m° = 36° \rightarrow m = 18°$.

18. **B.** First find $\angle CDG$ because it is supplementary to $128°$, and use the Triangle Sum Theorem to find $\angle DCG$. Alternatively, you could use the Exterior Angle Theorem, which tells you that the two opposite angles are equal to the outside angle of the third angle, so in this case $95° + \angle DCG = 128°$. Either way, we find that $\angle DCG = 33°$. $\angle DCG$ and $\angle FCB$ are opposite, so by the Opposite Angles Theorem they are congruent. Now that you know both $\angle FCB$ and $\angle BFC$ (given in the diagram), you can find $\angle FBC$ using the Triangle Sum Theorem: $\angle FCB + \angle BFC + \angle FBC = 180° \rightarrow 33° + 84° + \angle FBC = 180° \rightarrow \angle FBC = 63°$. $\angle FBC$ and $\angle ABE$ are opposite angles too, so they are also congruent. Now you know two out of the three angles in ÄABE, so you can apply the Triangle Sum Theorem a third and final time to find that $\angle AEB = 46°$.

19. **E.** If $\angle ACD$ is $38°$, then by the Triangle Sum Theorem, $\angle ADC$ is $52°$. Since that angle is bisected by DB, $\angle ADB$ and $\angle BDC$ are both $26°$. If we apply the Triangle Sum Theorem to ÄDBC, we find that $\angle DBC = 116°$. Thus, the sum of $\angle ADB$ and $\angle DBC$ is $26° + 116° = 142°$.

20. **D.** The sum of pairs of adjacent angles on a line will always be **180°**, so one pair will never be greater than or less than the other pair.

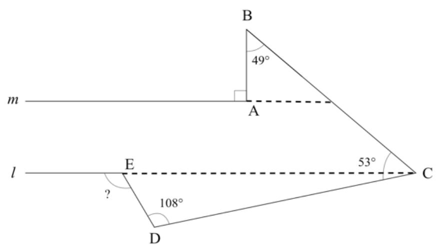
21. **B.** For an angle to be obtuse it must be greater than **90°** but less than **180°**, so the expression given must satisfy those two conditions as well: $90 < (180 - x) < 180$. Subtract $180°$ from both sides: $-90 < -x < 0$. Multiply all three parts of the expression by -1, and remember to compensate for the negative by changing the direction of the inequality signs: $90 > x > 0$. Alternatively, you could come to the same conclusion with logic. If you understand the definition of an obtuse angle, you know that you must subtract at least some value because an obtuse angle is less than 180, but cannot subtract more than 90 or your angle would no longer be obtuse.

22. C. The question could only be confusing if you weren't able to visualize the angles described. For our purposes, it doesn't really matter that there are rays. What matters is that you have two adjacent angles who share one side while their two individual sides form a line, so the angles are supplementary. It's a very simple set up: 

If the larger angle is x, then according to the question the smaller angle is $\frac{x}{5}$. Because the angles are supplementary, we know that $x+\frac{x}{5}=180°$. Solving for x, we find that $x=150°$. However, that is the larger angle. The smaller angle is $\frac{x}{5}=\frac{150°}{5}=30°.$

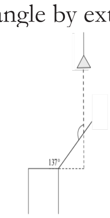
23. C. If we let $\angle BAC$ and $\angle BCA$ be x (they are congruent because they are both opposite to congruent sides), then $\angle ABC=7x$ and $x+x+7x=180°$. Solving for x yields $20°$. Because $ABCD$ is a regular quadrilateral so at its angles are equal to $90°$, $\angle EAB=90°+20°$ and $\angle ABC=7x=7(20°)=140°$. Using these values, $\angle ABC-\angle EAB=140°-110°=30°$.

24. D. If we were to extend the lines m and l forward until they both reach $\overline{BC}$, we get a two triangles: a right triangle with angle measures $90°$, $49°$, and $41°$ (found using the Triangle Sum Theorem), and an obtuse triangle with only one angle known so far, $108°$.



$\overline{BC}$ can be treated like a transverse line, and using the Corresponding Angles Theorem, we can split $\angle DCB$ into two different angle above and below the dotted line: $\angle ECB$, per the Corresponding Angles Theorem, is $41°$, and $\angle DCE=53°-41°=12°$. Now we can use the Triangle Sum Theorem again with the triangle ÄCDE that we created to find $\angle DEC$: $\angle DCE+\angle EDC+\angle DEC=180°\rightarrow 12°+108°+\angle DEC=180°\rightarrow \angle DEC=60°$. $\angle DEC$ and the angle we are trying to find, the angle $\overline{AB}$ makes with line l, are supplementary, so our answer is $180°-60°=120°$.

25. C. One way of looking this problem is to create a right triangle by extending the seat of the chair and the line of the lamp:



We can find one of the angles of this right triangle by finding the supplemental angle of $137°$, which is $43°$. Let's say that the angle that we want to find, the angle the lamp makes with the chair back, is x. Using the Exterior Angle Theorem, and setting our desired angle x, as the exterior angle, we see that $x=43°+90°=133°$. Alternatively, a longer way would be to solve for the third angle of the triangle we created and then find the corresponding supplemental answer, which would be the same answer that we just got.

26. E. If you were to treat $\overline{AC}$ and $\overline{DE}$ like two parallel lines, and treat both $\overline{BD}$ and $\overline{BE}$ as transverse lines, you would find that by the Alternate Interior Angles Theorem, $\angle 1\cong\angle 3$ and $\angle 2\cong\angle 5$. However, only $\angle 1\cong\angle 3$ is an answer choice.

27. D. This question uses the Exterior Angle Theorem and the idea of supplementary angles. Because and c are the exterior angles of extended triangle sides, $a=180-x$ and $c=180-y$. By the Exterior Angle Theorem, $b=x+y$. Thus, $a-b-c=(180-x)-(x+y)-(180-y)=180-x-x-y-180+y=-2x$.

28. D. Because we are given one of the angles at X, we can use the Supplementary Angles Theorem to get $\angle a.$ Thus, to find $\angle c$ we either need to know the measure of $\angle e$ and use the Triangle Sum Theorem, or we need to know that lines l and m are parallel *and* the measure of $\angle d$. Since each answer choice gives only one fact, we should look for the answer that can give us the measure of $\angle e$. Answer choice (A) only makes the problem more difficult, answer choice (B) would only help if we wanted to find $\angle b$, answer choice (C) tells us that the lines are parallel by taking the converse of the alternate interior angles theorem, but it doesn't give us any actual numerical values. Answer (D), however, gives us the value of $\angle f$, so we can use the Supplementary Angles Theorem to find the value of $\angle e$. Now that we know $\angle e$ and $\angle a$, we can find the value of $\angle c$ with the Triangle Sum Theorem.

29. D. Because the lines are parallel, all the corresponding angles are parallel, making any figures created similar, which in turn makes all the side lengths of those figures proportional. Because they are proportional we can set up the equation $\frac{2}{12}=\frac{\overline{CF}}{10}$, which when we solve tells us that $\overline{CF}=\frac{5}{3}$.

30. D. To start, is supplementary to the two angles that it is adjacent to, $\angle 9$ and $\angle 11$. Those angles are congruent to their corresponding angles on the parallel line below that intersects with the same transversal, $\angle 9$ with $\angle 12$, and $\angle 11$ with $\angle 15$. Thus, $\angle x$ is supplementary to all four of those angles, so our set is $\{9,11,12,15\}$.

31. E. The third angle in the triangle that the 22° angle and $\angle x$ is the supplement of the 127° degree angle, $180^\circ-127^\circ=53^\circ$, per corresponding angles. Thus, we find that $\angle x=180^\circ-22^\circ-53^\circ=105^\circ$.

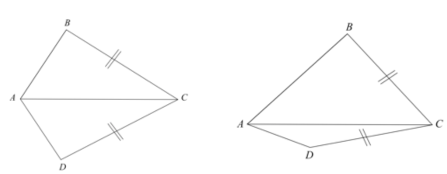
32. D. You only need one of the angles given, since $\angle EAF$ and $\angle DAF$ are supplementary. Because of this, $\angle DAF=180^\circ-44^\circ=136^\circ$.

33. B. In essence, the angles make up a same side interior pair. For instance, the top interior angle would be formed from $(6x-11)^\circ+(7x-4)^\circ$ and the bottom interior angle would be $(4x+8)^\circ$. The same side interior are supplementary, so $(6x-11)^\circ+(7x-4)^\circ+(4x+8)^\circ=180^\circ$. If we solve for x, we get $x=11$.

34. E. By the triangle sum theorem, $m\angle 3+m\angle 11+m\angle 6=180^\circ$, so II is true. I is true because angles $\angle 1$ and $\angle 10$ are the vertical angles of (are are thus congruent to) two of the interior angles of the triangle, and $\angle 6$ is the third interior angle. III is true because $\angle 8$ is the vertical vertical angle of $\angle 6$, which when summer with the other two interior angles also equals 180°.

35. D. Because the trapezoid is isosceles, the trapezoid is symmetrical about a central axis, meaning that $\angle ACB\cong\angle BDA$, and $\angle BCD\cong\angle ADC$. Since that's not a commonly taught concept, you can also come to the same conclusion by assuming that because it says isosceles, two side and two angles must be the same length. Since by the definition of a trapezoid the top and bottom sides are not equal, the left and right sides must be, and the angles are congruent because if you look at the two triangles that are formed, all three sides of one triangle is congruent to all three of the other, so the angles are congruent as well. Thus, $\angle CAD=180^\circ-\angle ACD-\angle CDA=180^\circ-(40^\circ+37^\circ)-37^\circ=66^\circ$.

36. C. This problem is best approached by process of elimination. Answer (A) is impossible because the problem literally says that the two are equal. Answer (B), (D), and (E) are wrong because the figure described can be drawn such that $AB<BC$ and/or $AD>CD$ and/or $AB\neq AD$, as shown below.



37. E. It you look at a parallelogram and arbitrarily assign vertices, you see that $\angle BCD$ and $\angle CDA$ are adjacent. In a parallelogram, opposite angles are congruent and adjacent angles are supplementary, to they must add up to 180°.