

ACADEMIC CHALLENGE FOR
ACES
ENGINEERING AND SCIENCE



EASTERN ILLINOIS UNIVERSITY

2023 Academic Challenge

REGIONAL ENGINEERING GRAPHICS EXAM

Engineering Graphics Test Production Team

Ryan Brown, Illinois State University – Author/Team Leader

Ted Branoff, Illinois State University – Reviewer

GENERAL DIRECTIONS

Please read the following instructions carefully. This is a timed test; any instructions from the test supervisor should be followed promptly.

The test supervisor will give instructions for filling in any necessary information on the answer sheet. Most Academic Challenge sites will ask you to indicate your answer to each question by marking an oval that corresponds to the correct answer for that question. One oval should be marked to answer each question. Multiple ovals will automatically be graded as an incorrect answer.

Be sure ovals are marked as  , not  ,  ,  , etc.

If you wish to change an answer, erase your first mark completely before marking your new choice.

You are advised to use your time effectively and to work as rapidly as you can without losing accuracy. Do not waste your time on questions that seem too difficult for you. Go on to the other questions, and then come back to the difficult ones later if time remains.

Time: 40 Minutes

Number of Questions: 40

DO NOT OPEN TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO!

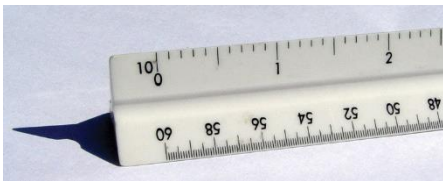
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Academic Challenge
Engineering Graphics Test (Regional) - 2023

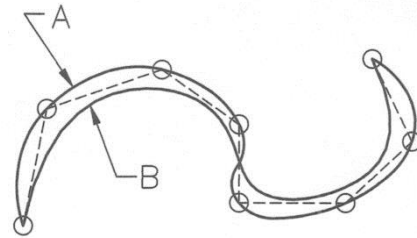
1. Which pair of ASME standard line types below features an identical dash pattern, but with different thicknesses?
 - A. Short-break and Long-break
 - B. Visible and Stitch
 - C. Extension and Cutting-plane
 - D. Center and Chain
 - E. Phantom and Hidden

2. What measuring instrument is shown in the illustration below?

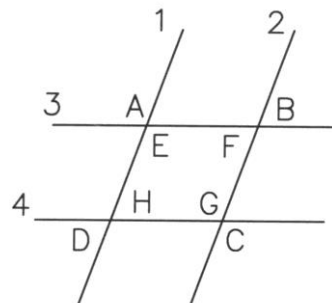


- A. Architect's Scale
 - B. Triangular Ruler
 - C. Mechanical Engineer's Scale
 - D. Metric Scale
 - E. Civil Engineer's Scale
3. Which of the following architectural scales would be suitable for measuring at "one-eighth size"?
 - A. $1/4" = 1'-0"$
 - B. $1/2" = 1'-0"$
 - C. $3/4" = 1'-0"$
 - D. $1-1/2" = 1'-0"$
 - E. $3" = 1'-0"$

4. With AutoCAD™ software, a "polyline" can be drawn through a series of points, as shown by the hidden line in the illustration below. As labeled at "A" the software can "fit a curve" through the points. What geometric term can be applied to "B", which creates a curve that "averages" out the points?

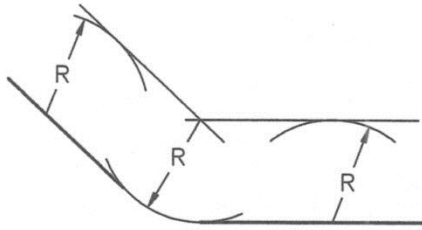


- A. Tangent curve
 - B. Rhombus
 - C. Spline
 - D. French curve
 - E. Average curve
5. Given parallel lines 1 & 2, and parallel lines 3 & 4 (not perpendicular to 1 & 2), which of the formula below is **TRUE**?

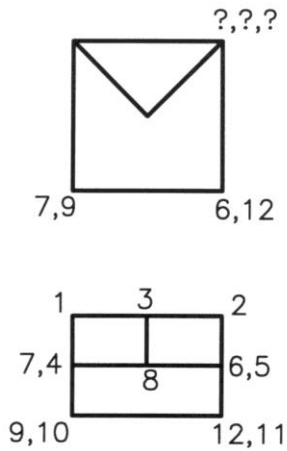


- A. $A + B + C + D = 360^\circ$
 - B. $D + H + F + B = 180^\circ$
 - C. $A + G = 180^\circ$
 - D. $B + A = 90^\circ$
 - E. $A + E + G + C = 360^\circ$

6. What caption is appropriate for the illustration below?

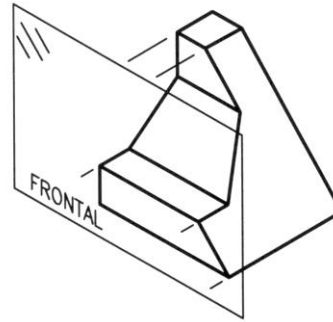


- A. Developing a chamfer
 - B. Diagramming a parabola
 - C. Creating an ogee curve
 - D. Finding the center point for an arc tangent to two lines
 - E. Bisecting an arc
7. What sequence of numbers would identify the right rear corner of the top view? (Note: sequence the numbers from closest to furthest)



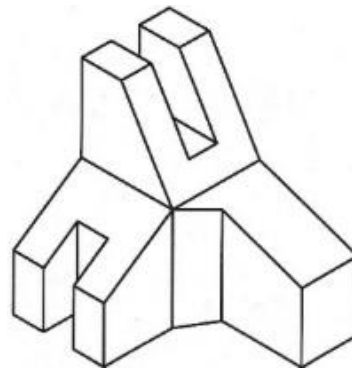
- A. 1,4,9
- B. 3,8,11
- C. 4,8,5
- D. 11,5,9
- E. 2,5,11

8. Considering **ALL** surfaces of the object illustrated below, how many of the surfaces will be represented as **true size and shape** in the front view? [i.e. How many are parallel with the frontal plane?]



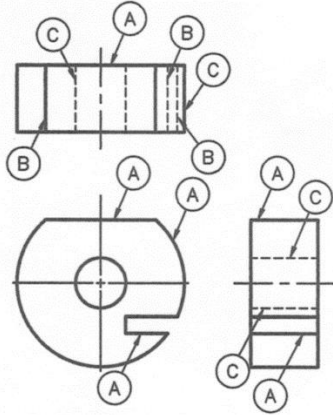
- A. 2
- B. 3
- C. 4
- D. 5
- E. 6

9. In isometric grid sketches, **normal** edges of an object all align with the isometric grid. How many non-isometric lines (**inclined** or **oblique** edges) are there when creating the isometric sketch of the object below?



- A. 12
- B. 13
- C. 14
- D. 15
- E. 16

10. In the illustration below, there are three groups, or categories, for what a line means in the multiview drawing. These are identified as either A, B, or C. From the answers below, what would be an appropriate title for category B?



- A. Maximum curved surface element
- B. Edge view of a flat surface
- C. Tangent element where a curved surface merges with a flat surface
- D. Hidden hole lines
- E. Just an intersection edge between two surfaces

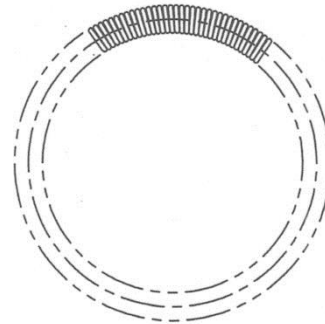
11. The **SIX** principal views each exhibit width, height, and/or depth. Fill in the following blanks accordingly: Height is exhibited in ___ views, width is exhibited in ___ views, while depth is exhibited in ___ views.

- A. 2 – 4 – 4
- B. 4 – 2 – 4
- C. 4 – 4 – 4
- D. 4 – 4 – 2
- E. 2 – 2 – 2

12. What type of section view is best suited to show the cross-sectional shape of a spoke, super-imposed directly on the longitudinal view of the spoke?

- A. Aligned
- B. Revolved
- C. Removed
- D. Offset
- E. Half

13. What type of line is being used within this **coil spring** drawing to minimize repetitious detail?



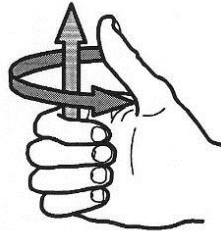
- A. Chain
- B. Phantom
- C. Center
- D. Hidden
- E. Long break

14. *Fill in the blank:* Any auxiliary view projected adjacent to the top view can be referred to as a _____ auxiliary because it would feature this dimension.

- A. length
- B. depth
- C. height
- D. width
- E. breadth

15. Which of the following CAD functions below (common to all CAD programs) would allow the user to duplicate the left half of a symmetrical shape to create a mirror image of the right half?
- A. MATRIX
 - B. FILLET
 - C. MIRROR
 - D. EXTRUDE
 - E. LOFT

16. The illustration below is representing a 3D CAD principle. What does the thumb represent?

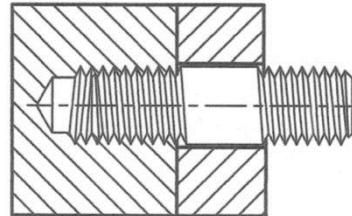


- A. The X axis
 - B. The Y axis
 - C. The Z axis
 - D. Positive axis direction for X, Y, or Z
 - E. Negative axis direction for X, Y, or Z
17. If a drawing of a part has a **hole** with a tolerance dimension of $.534 - .522$ and the mating **shaft** drawing specifies a shaft diameter of $.505 \pm .015$, what is the **loosest fit** of these two parts?
- A. $.002''$
 - B. $.014''$
 - C. $.029''$
 - D. $.032''$
 - E. $.044''$

18. What CAD function could be appropriate for creating the 2D or 3D geometry of a countersink at the opening of a hole?
- A. CHAMFER
 - B. REAM
 - C. FILLET
 - D. DRILL
 - E. KNURL

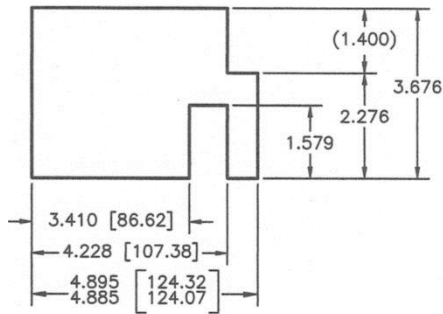
19. Which of the following section view types **NEVER** features a cutting plane line?
- A. Aligned
 - B. Broken-out
 - C. Revolved
 - D. Offset
 - E. Half

20. What fastener is being featured in the sectional assembly below?



- A. Machine screw
- B. Set screw
- C. Wood screw
- D. Stud
- E. Cap screw

21. What aspect of engineering drawing dimensioning is **NOT** featured in the illustration below?

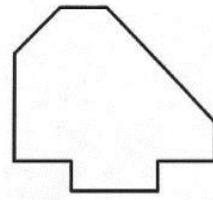


- A. Baseline dimensioning
- B. Geometric tolerancing
- C. Dual dimensioning
- D. Limit method tolerance
- E. Reference dimension

22. In local notes such as **.125 X 45°**, the letter "X" is read as "by". What other word might "X" represent?

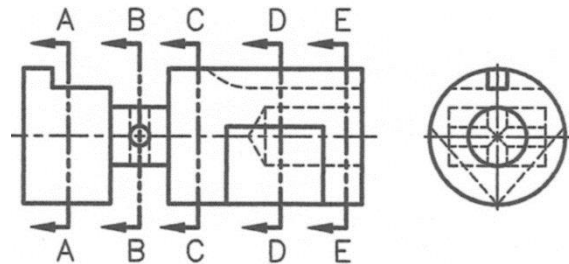
- A. Maximum
- B. Typical
- C. Times
- D. Through
- E. External

23. How many dimensions are needed to fully describe (constrain) this geometric shape?



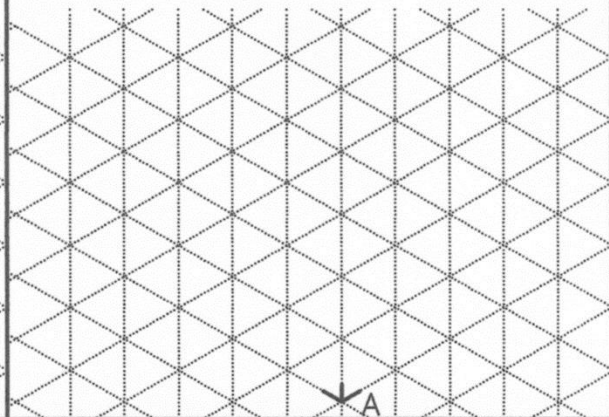
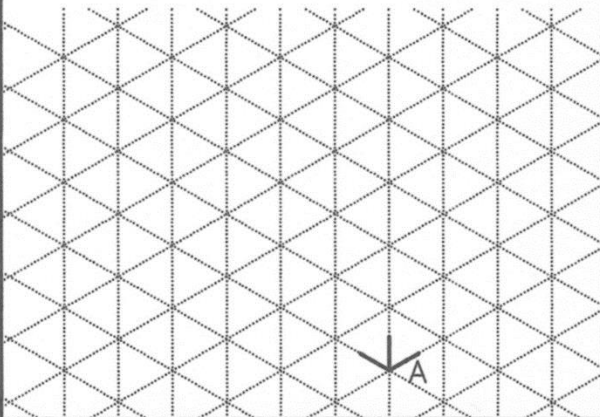
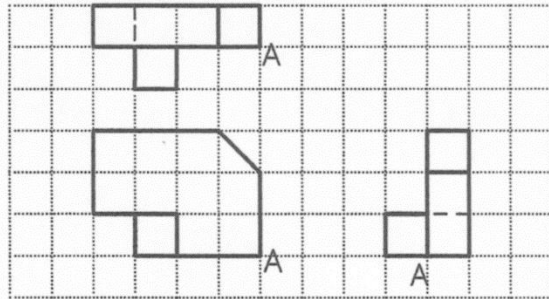
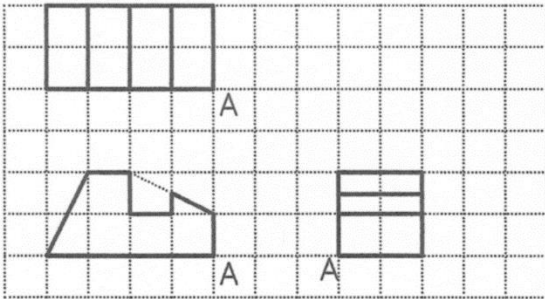
- A. 5
- B. 6
- C. 7
- D. 8
- E. 9

24. This multiview drawing indicates there are to be five **removed** section views on the drawing. Which of the five would feature a circle, a straight line chord segment, and one bounded area of section lines?



- A. A-A
- B. B-B
- C. C-C
- D. D-D
- E. E-E

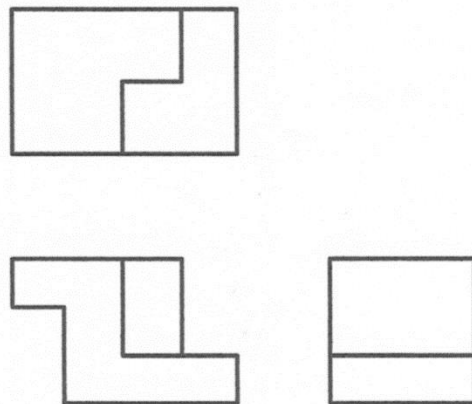
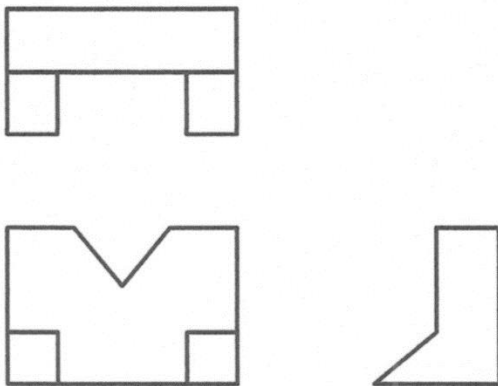
**PROBLEMS 25 & 26: CREATE ISOMETRIC SKETCHES
SELECT AN ANSWER THAT REPRESENTS THE NUMBER OF SEGMENTS REQUIRED**



25. NUMBER OF LINE SEGMENTS:
A. 16 B. 17 C. 18 D. 19 E. 20

26. NUMBER OF LINE SEGMENTS:
A. 17 B. 18 C. 19 D. 20 E. 21

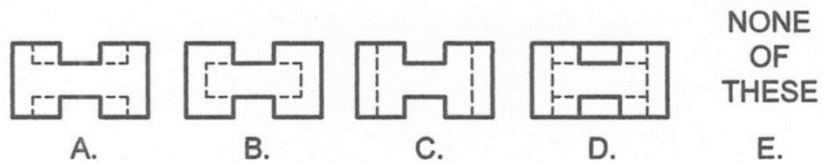
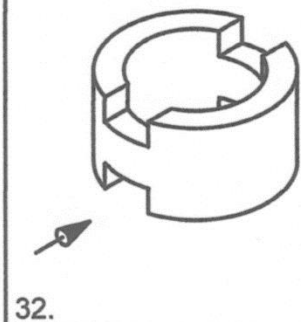
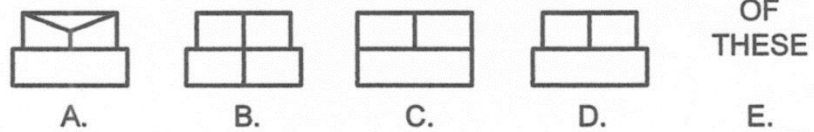
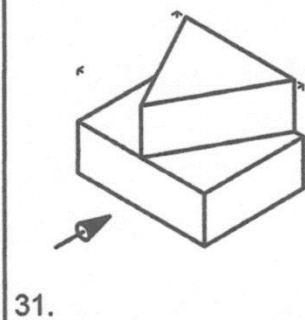
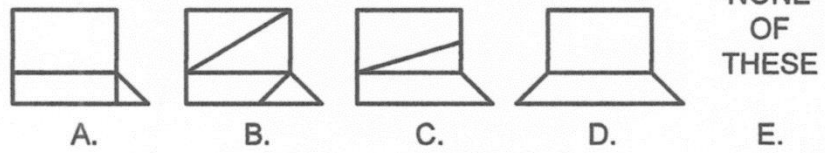
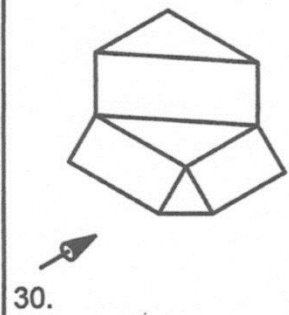
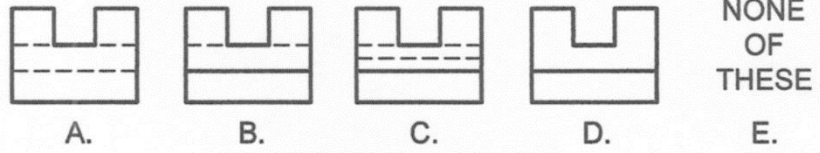
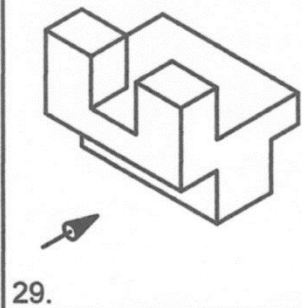
**PROBLEMS 27 & 28: MISSING LINE PROBLEMS: SELECT AN ANSWER THAT
CORRESPONDS WITH THE LEAST NUMBER OF MISSING LINE SEGMENTS (VISIBLE
AND HIDDEN) IT WILL TAKE TO CREATE A CORRECT MULTIVIEW DRAWING**

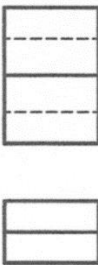




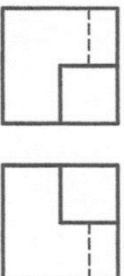
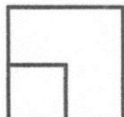

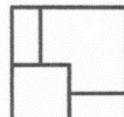
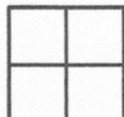
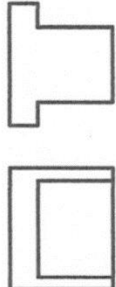
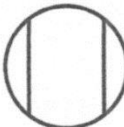
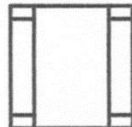
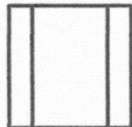
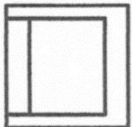
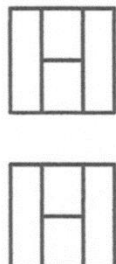


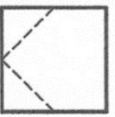
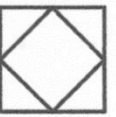


27. MINIMUM NUMBER OF LINES:
A. 5 B. 6 C. 7 D. 8 E. 9

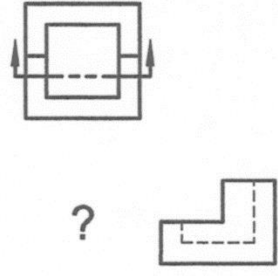
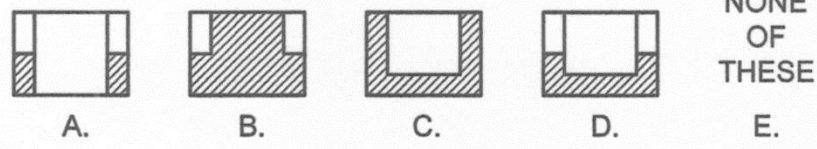
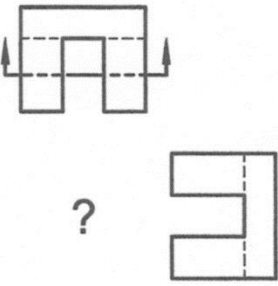
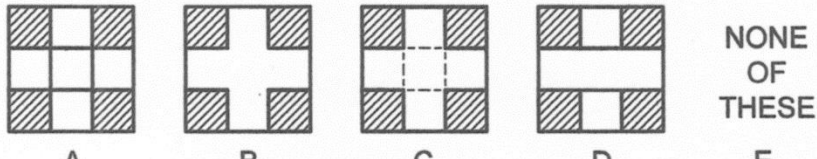
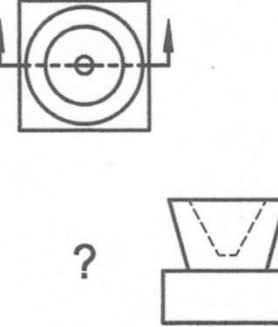
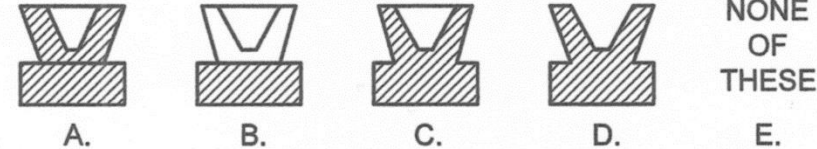
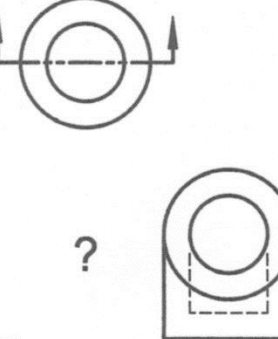
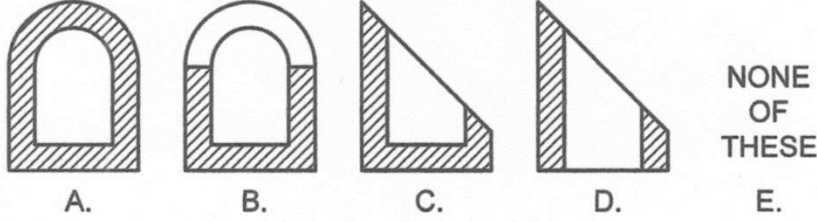
28. MINIMUM NUMBER OF LINES:
A. 2 B. 3 C. 4 D. 5 E. 6

FOR EACH PROBLEM, SELECT THE CORRECT FRONT VIEW
 NOTE: CENTER LINES OMITTED ON THIS TEST PAGE



		FOR EACH PROBLEM, SELECT THE CORRECT SIDE VIEW NOTE: CENTER LINES OMITTED ON THIS TEST PAGE				
33.	 <p>?</p>	 <p>A.</p>	 <p>B.</p>	 <p>C.</p>	 <p>D.</p>	<p>NONE OF THESE</p> <p>E.</p>
34.	 <p>?</p>	 <p>A.</p>	 <p>B.</p>	 <p>C.</p>	 <p>D.</p>	<p>NONE OF THESE</p> <p>E.</p>
35.	 <p>?</p>	 <p>A.</p>	 <p>B.</p>	 <p>C.</p>	 <p>D.</p>	<p>NONE OF THESE</p> <p>E.</p>
36.	 <p>?</p>	 <p>A.</p>	 <p>B.</p>	 <p>C.</p>	 <p>D.</p>	<p>NONE OF THESE</p> <p>E.</p>

FOR EACH PROBLEM, SELECT THE CORRECT FRONT SECTIONAL VIEW
 NOTE: CENTER LINES OMITTED ON THIS TEST PAGE

<p>37.</p> 	 <p>A. B. C. D. E.</p>
<p>38.</p> 	 <p>A. B. C. D. E.</p>
<p>39.</p> 	 <p>A. B. C. D. E.</p>
<p>40.</p> 	 <p>A. B. C. D. E.</p>

