

# 2021 Academic Challenge

## ENGINEERING GRAPHICS TEST – SECTIONAL

– This Test Consists of 40 Questions –

### Engineering Graphics Test Production Team

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### 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 \*\*\***

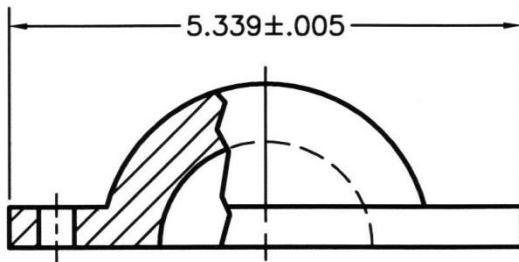
**DO NOT OPEN TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO!**

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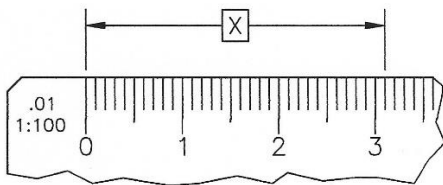
Academic Challenge  
Engineering Graphics Test (Sectional) – 2021

1. In the illustration below, there are several ASME standard types of lines. Which line is NOT featured?



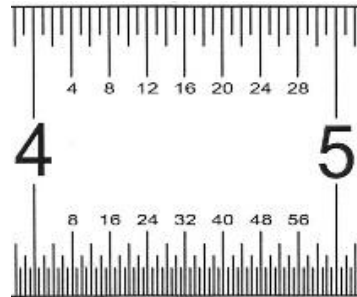
- A. Hidden
- B. Extension
- C. Short-break
- D. Center
- E. Cutting-plane

2. The illustration below is based on a triangular metric scale. This edge can be used for reducing 1 meter distances by a factor of 1:100. What actual distance is indicated by the X dimension?



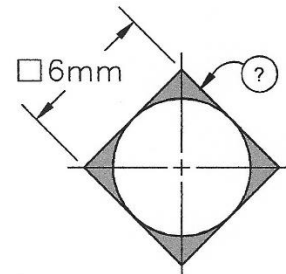
- A. .31 cm
- B. 31 cm
- C. 3.1 mm
- D. 31 mm
- E. 310 mm

3. On this enlarged view of a machinist scale, what is the true distance between the 24 mark and the 56 mark along the bottom edge?



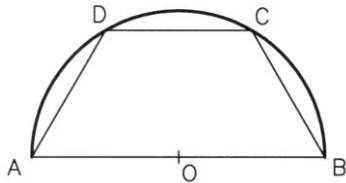
- A. 8 mm
- B. 1/4"
- C. 16 mm
- D. 1/2"
- E. 32 mm

4. Calculate the area of the dark area between the circle and square, and select an answer nearest your calculation:

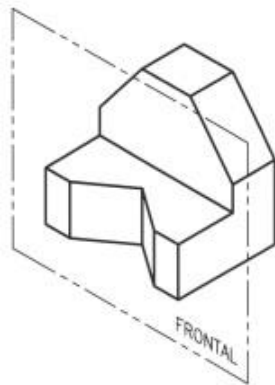


- A. 3.87 mm<sup>2</sup>
- B. 7.74 mm<sup>2</sup>
- C. 9.42 mm<sup>2</sup>
- D. 17.16 mm<sup>2</sup>
- E. 28.26 mm<sup>2</sup>

5. A semi-circular arc shown below has a radius of  $1\text{-}\frac{9}{16}$ ". A series of three equal line segments connect A to B through points D and C. What is the sum distance A to D to C to B?

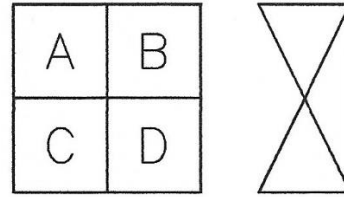


- A. 3.125"  
 B.  $3\text{-}\frac{9}{16}$ "  
 C. 4.6875"  
 D. 4.906"  
 E. 9.812"
6. The definition for a **normal** surface is one that is parallel to a principal plane of projection, and perpendicular to the other two. For the object illustrated below, counting ALL surfaces of the object, how many are **normal** surfaces parallel with the **frontal** plane?

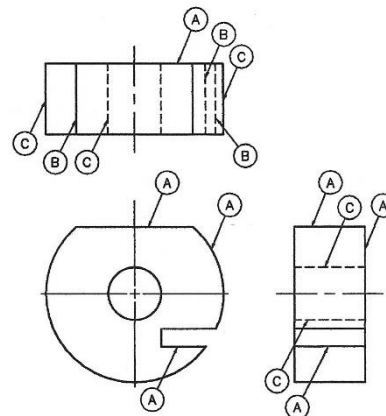


- A. 2  
 B. 3  
 C. 4  
 D. 5  
 E. More than 5

7. With respect to a viewer in **front** of the object, looking at the **front** view (the one with labels), which of the following statements is FALSE?

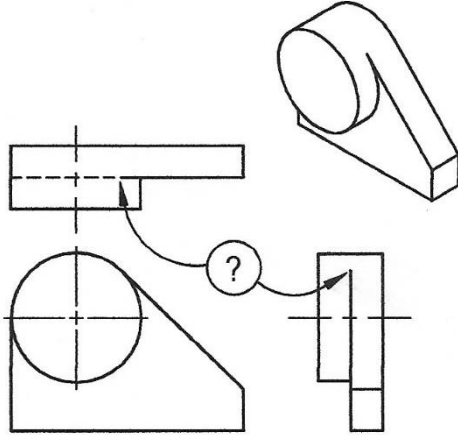


- A. A & C are on the same plane  
 B. B & C are inclined to the viewer  
 C. C is closer to the viewer than D  
 D. A is closer to the viewer than B  
 E. None of the four labeled surfaces appear true size
8. In the illustration below, there are three groups, or categories, for lines in the multiview drawing, identified as A, B, or C. From the answers below, what would be an appropriate title for category B?



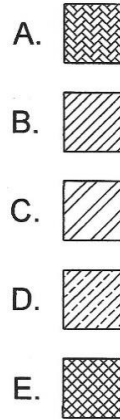
- A. Maximum curved surface element  
 B. Edge view of a flat surface as a line  
 C. Tangent element where a curved surface merges with a flat surface  
 D. Hidden hole lines  
 E. Just an intersection edge between two surfaces

9. In the illustration below, there are a couple of line segments that just end abruptly. What best describes how those points are determined when constructing a 2D multiview drawing?

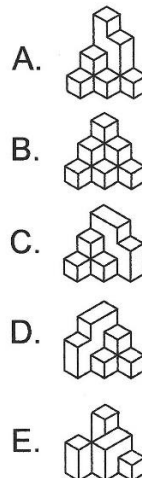
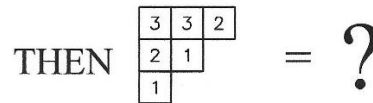
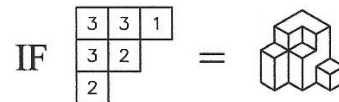


- A. Projected from the point of tangency shown in the front view
  - B. 1/3 of the distance between the center line and outer contour
  - C. Not a real established point, but rather estimated to the approximate location
  - D. Calculated with a tangent function by the computer
  - E. These are called runouts, and require an auxiliary view to calculate true position
10. Which type of section view is not lined up with any other view, nor is it superimposed on any other view?
- A. Aligned
  - B. Removed
  - C. Revolved
  - D. Full
  - E. Broken-out

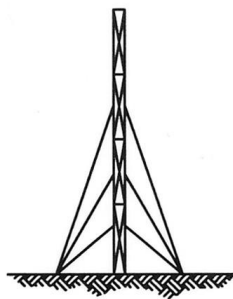
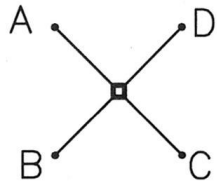
11. Identify a section line (hatching) pattern that could be used to indicate the material is stainless steel.



12. Identify an isometric pictorial of an object that has a top view as indicated by the "height" numbers on the top view.

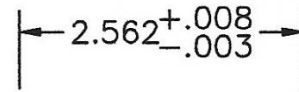


13. An engineer has a drawing of a microwave tower with guy-wires, but realizes he/she may need additional information to solve for the true length of the wires. Identify a possible solution from the answers below, using wires going to point B as the subject.

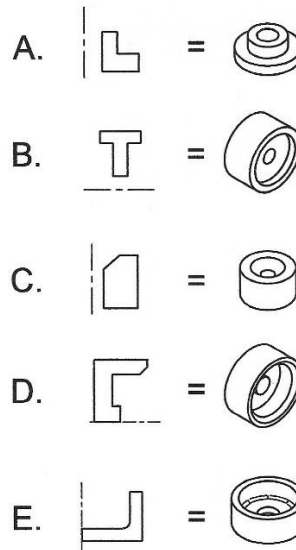


- A. Solve for hypotenuse B with measurements from the front view
  - B. Use the lines in the front view but multiply by a factor of 1.414
  - C. Create a right side view and the wires will be true length in that view
  - D. Create an auxiliary view projected from the top view and the wires will be true length in that view
  - E. Create an isometric pictorial view
14. The words TAPER, COILED SPRING, GROOVED, and STRAIGHT all refer to types of:
- A. Set screws
  - B. Pins
  - C. Keys
  - D. Washers
  - E. Rivets

15. Specifically, what common term is applied to the way this dimension specifies the tolerance?

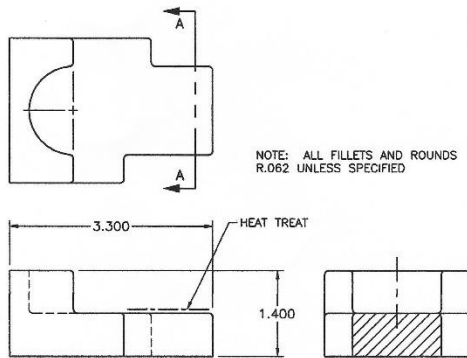


- A. Bilateral
  - B. Unilateral
  - C. Equilateral
  - D. Limit method
  - E. Basic dimension
16. In the set of answers illustrated below, 2D "shapes" or "regions" are shown next to an axis of revolution. Select the answer that is NOT showing a correct 3D model revolved from a matching 2D shape and center axis.



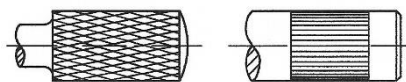
17. In the CAD system, the drawing below was scaled 1:2 and the annotations were sized to be legible and neatly organized, but then the scale of the drawing changed to 1:4.

Analyze the answers below to identify the FALSE statement.



- A. The dashes in the linework will all need to be increased so they don't appear smaller
- B. The general note about fillets and rounds will need resized
- C. The section line spacing will need to be adjusted
- D. All the dimensioning variables such as arrow size, gaps, extensions, etc. will need to be adjusted
- E. The fillets and rounds on the objects will need to be increased

18. As shown in the two examples below, the surface of a cylinder may feature a \_\_\_\_\_, which can be created in a diamond pattern or a straight line pattern.



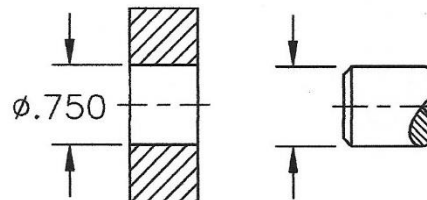
- A. knurl
- B. broach
- C. tap
- D. press
- E. stamp

19. The chart below assists the designer with standard ASME thread counts for coarse, fine, and extra fine threads for UNIFIED threaded features. What diameter hole should be drilled before tapping a 1/2-20UNF-2B thread?

NOMINAL DIAMETER	BASIC DIAMETER	COARSE UNC		FINE UNF		EXTRA FINE UNEF	
		THDS PER IN	TAP DRILL DIA	THDS PER IN	TAP DRILL DIA	THDS PER IN	TAP DRILL DIA
4	.112	40	No.43	48	No.42		
6	.138	32	No.36	40	No.33		
8	.164	32	No.29	36	No.29		
10	.190	24	No.25	32	No.21		
12	.216	24	No.16	28	No.14	32	No.13
1/4	.250	20	No.7	28	No.3	32	.2189
5/16	.3125	18	F	24	I	32	.2813
3/8	.375	16	.3125	24	Q	32	.3438
7/16	.4375	14	U	20	.3906	28	.4062
1/2	.500	13	.4219	20	.4531	28	.4688
9/16	.5625	12	.4844	18	.5156	24	.5156
5/8	.625	11	.5313	18	.5781	24	.5781
11/16	.6875	...	...	...	...	24	.6406
3/4	.750	10	.6563	16	.6875	20	.7031

- A. .3906"
- B. .4219"
- C. .4531"
- D. .4688"
- E. .5000"

20. The parts illustrated below have a size tolerance of .010". If the MMC of the hole is .750", and the tightest fit (allowance) is to be .003", then what is the "loosest fit"?

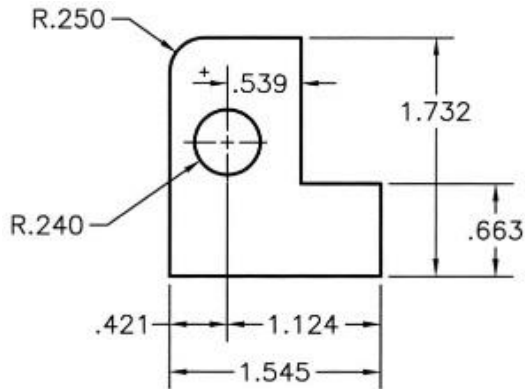


- A. .008"
- B. .015"
- C. .013"
- D. .020"
- E. .023"

21. In dimensioning, whether it be linear dimensions or local notes, which of the following words has an alphabet character rather than a geometric shape symbol?

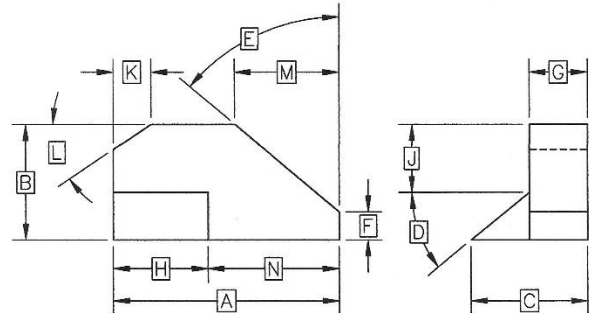
- A. Diameter
- B. Counterbore
- C. Deep
- D. Spherical
- E. Countersink

22. The view dimensioned below has several poor choices to fix. Which choice below is NOT a fix?



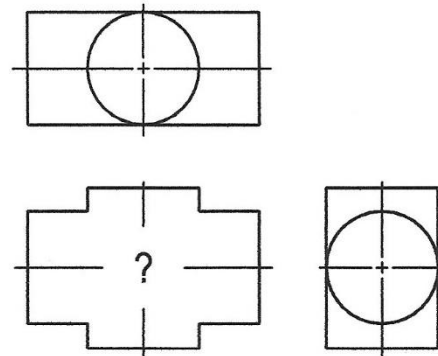
- A. Change hole size to a diameter dimension
- B. Eliminate either .421 dimension or the 1.124 dimension
- C. Move 1.732 dimension beyond the .663 dimension
- D. Move .539 dimension off the view
- E. Add location dimensions for the corner arc center point

23. The illustration below exhibits superfluous dimensioning. While there are multiple solutions, which group of three dimensions below could be eliminated to resolve the issue?



- A. A, M, & K
- B. M, N, & D
- C. C, D, & J
- D. B, L, & G
- E. E, L, & H

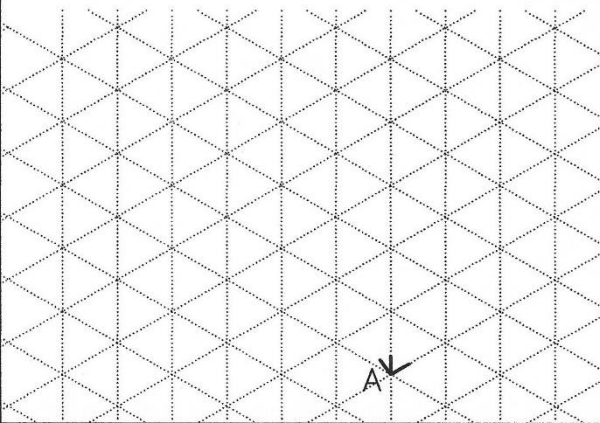
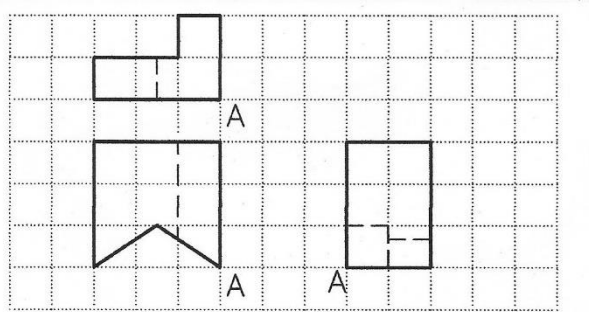
24. The front view of this drawing is incomplete. What does the true projection of the intersection between these two cylindrical forms look like?



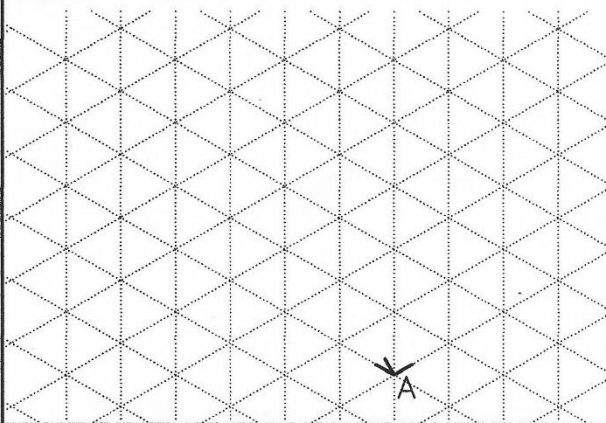
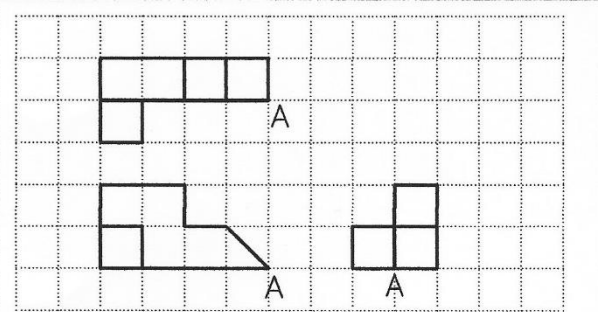
- A. Two irregular curves
- B. Two half ellipses
- C. Four straight line segments in the shape of a square
- D. An "X" shape connecting the interior corners
- E. Two perfect semi-circles



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

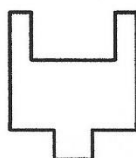
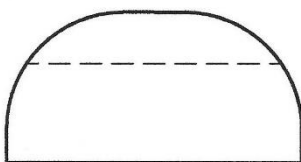
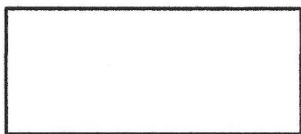


25. NUMBER OF LINE SEGMENTS:  
A. 10 B. 11 C. 12 D. 13 E. 14

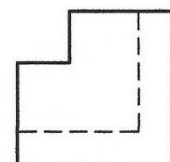
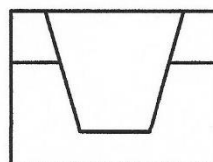
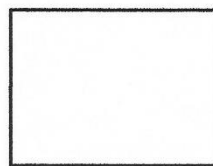


26. NUMBER OF LINE SEGMENTS:  
A. 24 B. 25 C. 26 D. 27 E. 28

**PROBLEMS 27 & 28: MISSING LINE PROBLEMS: SELECT AN ANSWER THAT  
CORRESPONDS WITH THE LEAST NUMBER OF LINE SEGMENTS (VISIBLE AND/OR  
HIDDEN) STILL NEEDED TO CREATE A CORRECT AND VALID MULTIVIEW DRAWING**

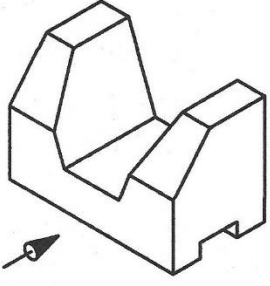

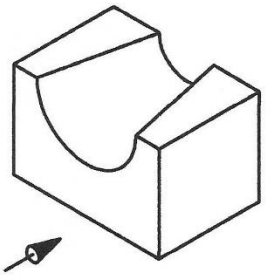
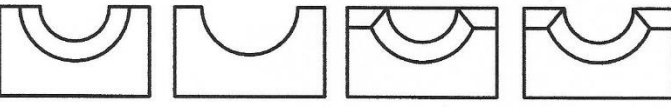
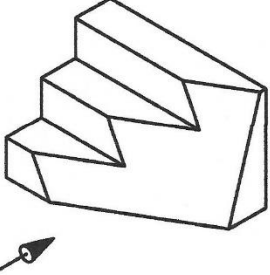

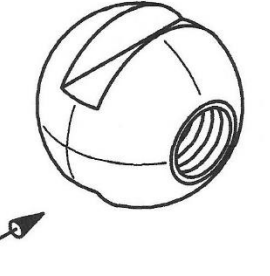
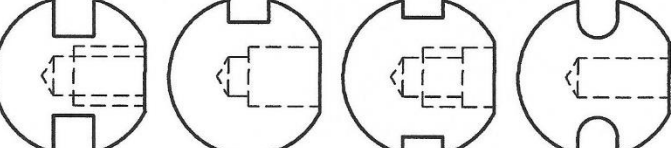


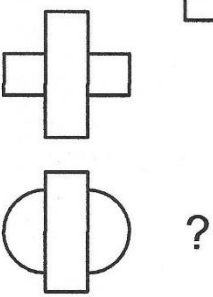
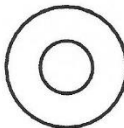
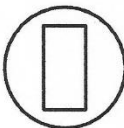
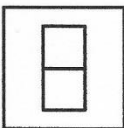

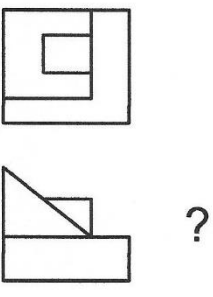
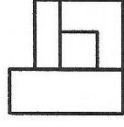
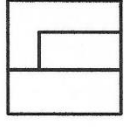
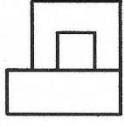
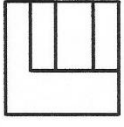
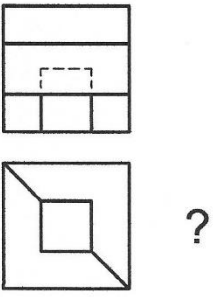
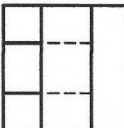
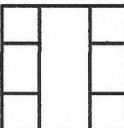
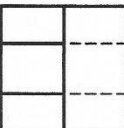
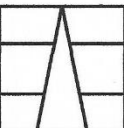
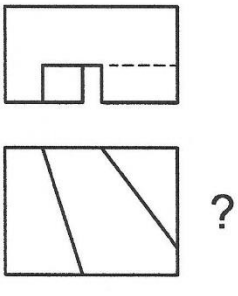
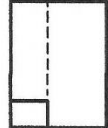
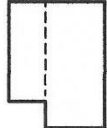
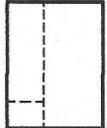
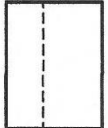
27. MINIMUM NUMBER OF LINES:  
A. 3 B. 4 C. 5 D. 6 E. 7



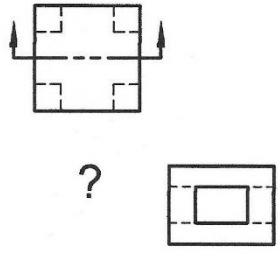
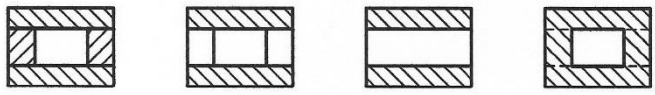
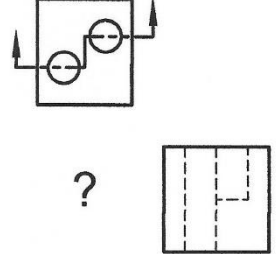
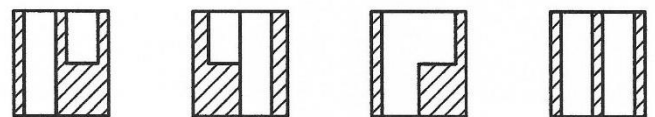
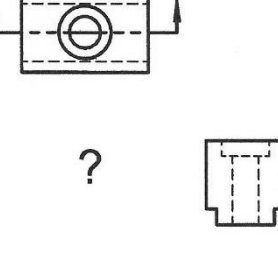
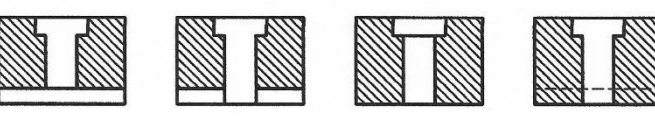
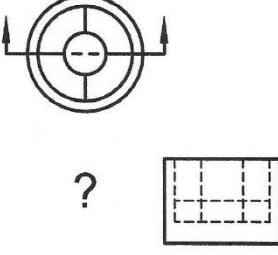
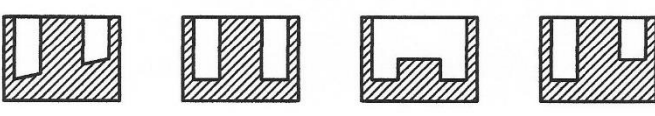
28. MINIMUM NUMBER OF LINES:  
A. 5 B. 6 C. 7 D. 8 E. 9

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

<p>29.</p> 	 <p>A.      B.      C.      D.</p>	<p>NONE OF THESE</p> <p>E.</p>
<p>30.</p> 	 <p>A.      B.      C.      D.</p>	<p>NONE OF THESE</p> <p>E.</p>
<p>31.</p> 	 <p>A.      B.      C.      D.</p>	<p>NONE OF THESE</p> <p>E.</p>
<p>32.</p> 	 <p>A.      B.      C.      D.</p>	<p>NONE OF THESE</p> <p>E.</p>

		FOR EACH PROBLEM ON THIS PAGE, SELECT A SIDE VIEW NOTE: CENTER LINES OMITTED ON THIS TEST				
<p>33.</p>  <p>?</p>	 <p>A.</p>  <p>B.</p>  <p>C.</p>  <p>D.</p> <p style="text-align: right;">NONE OF THESE</p> <p style="text-align: center;">E.</p>					
<p>34.</p>  <p>?</p>	 <p>A.</p>  <p>B.</p>  <p>C.</p>  <p>D.</p> <p style="text-align: right;">NONE OF THESE</p> <p style="text-align: center;">E.</p>					
<p>35.</p>  <p>?</p>	 <p>A.</p>  <p>B.</p>  <p>C.</p>  <p>D.</p> <p style="text-align: right;">NONE OF THESE</p> <p style="text-align: center;">E.</p>					
<p>36.</p>  <p>?</p>	 <p>A.</p>  <p>B.</p>  <p>C.</p>  <p>D.</p> <p style="text-align: right;">NONE OF THESE</p> <p style="text-align: center;">E.</p>					

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

<p>37.</p> 	 <p>A.      B.      C.      D.</p> <p>NONE OF THESE</p> <p>E.</p>
<p>38.</p> 	 <p>A.      B.      C.      D.</p> <p>NONE OF THESE</p> <p>E.</p>
<p>39.</p> 	 <p>A.      B.      C.      D.</p> <p>NONE OF THESE</p> <p>E.</p>
<p>40.</p> 	 <p>A.      B.      C.      D.</p> <p>NONE OF THESE</p> <p>E.</p>