

2022 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.

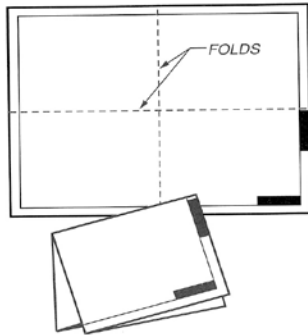
***** Time: 40 Minutes *****

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

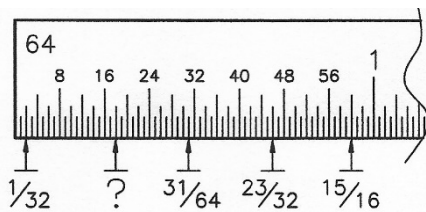
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Academic Challenge
Engineering Graphics Test (Sectional) – 2022

1. In the illustration below, what size paper is being folded to 8.5" x 11" in the illustration below?



- A. A
B. B
C. C
D. D
E. E
2. What decimal measurement is equivalent to the tick mark that features a question mark?



- A. .125"
B. .200"
C. .250"
D. .281"
E. .312"

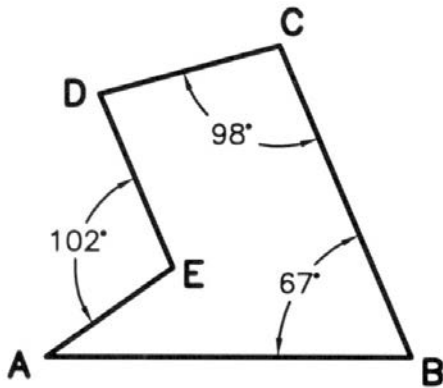
3. Model cars are commonly produced at 1/25th scale. What would be the approximate length of a 2022 Corvette **model**, given the real-life bumper-to-bumper distance is 15'-2"?



- A. 6.75"
B. 7.00"
C. 7.25"
D. 7.50"
E. 7.75"
4. Across the flats, a hexagon head bolt measures 1.5 times the body diameter. The AutoCAD™ POLYGON command prompts for three inputs: 1) Number of sides?; 2) Circumscribe or Inscribe?; and 3) Radius Value? Which of the following answer sets would be the proper three answers to draw the head of a 1/4" body diameter cap screw:

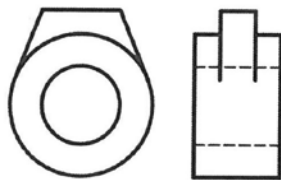
- A. 6; Circumscribe; 3/16
B. 8; Inscribe; 3/8
C. 6; Inscribe; 3/16
D. 8; Circumscribe; 3/8
E. 6; Circumscribe; 3/8

5. Assuming segment DE is parallel with segment BC, how many degrees are there in angle E-A-B?



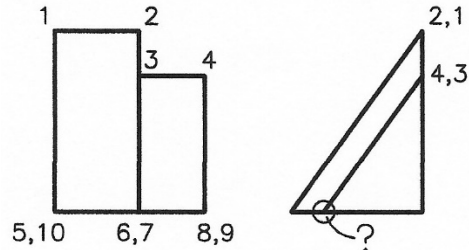
- A. 20°
- B. 35°
- C. 43°
- D. 51°
- E. 63°

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?



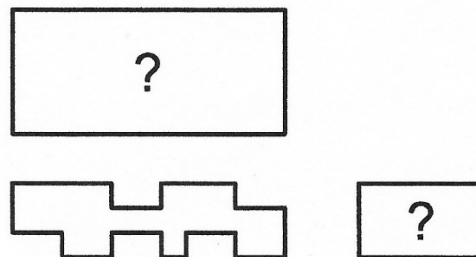
- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

7. In engineering education, it is common to number the vertices of an object to help solve a problem. In the illustration, what numbers should be assigned to the corner within the circle, as shown on the side view?



- A. 6,8
- B. 6,5
- C. 7,9
- D. 8,7
- E. 9,10

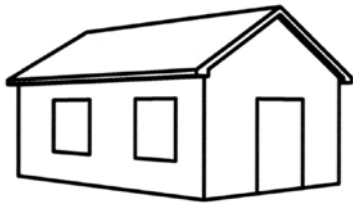
8. The **front view** illustrated below is complete. The **top view** and **side view** are both missing visible and hidden lines. How many **VISIBLE** and **HIDDEN** lines are missing? (*Answers are given in separate quantities.*)



- A. Visible = 3; Hidden = 6
- B. Visible = 4; Hidden = 2
- C. Visible = 5; Hidden = 5
- D. Visible = 3; Hidden = 2
- E. Visible = 4; Hidden = 3

9. How many line segments will be required to create two views (front and top) of an octagon-based right pyramid, 3" across the flats, and 2" tall?
- A. 13
 - B. 15
 - C. 17
 - D. 19
 - E. 23

10. What pictorial drawing method was used to create the illustration below?

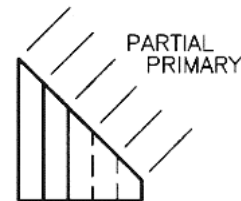


- A. Oblique
 - B. Isometric
 - C. One-point perspective
 - D. Trimetric
 - E. Two-point perspective
11. The top view of a 2" cube shows the circular view of a 1/2" diameter through hole, with a 1" diameter by 82° countersink. If a cutting plane passes through the axis of the hole, how many visible line segments are required to create a full section front view?
- A. 7
 - B. 8
 - C. 9
 - D. 10
 - E. 11

12. What term is equivalent to the formula illustrated below?

$$\underline{\hspace{2cm}} = MMC^{\text{Hole}} - MMC^{\text{Shaft}}$$

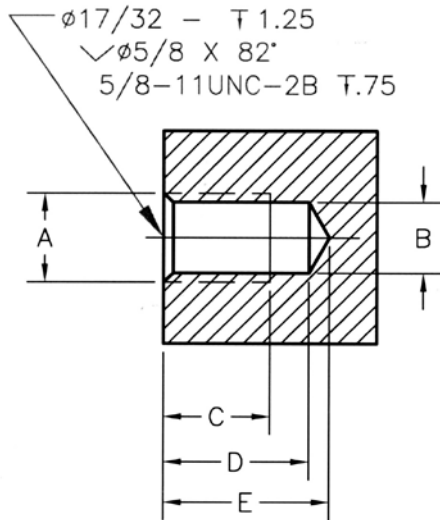
- A. Allowance
 - B. Tolerance
 - C. Limits of Clearance
 - D. Interference
 - E. Clearance
13. For the front view illustrated below, which of the views below could be a partial primary auxiliary view of the inclined surface?



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

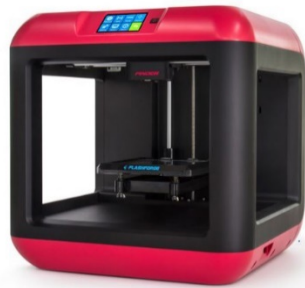
- E. ALL OF THE ABOVE

14. Read the note that specifies the machining specifications and threads for the featured hole. Identify the one distance that is not specified in the note.



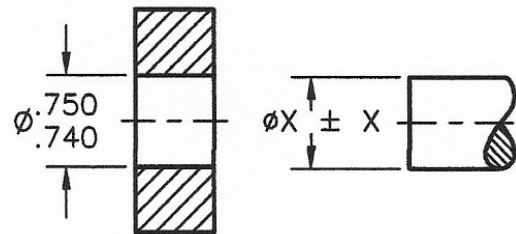
- A. A
- B. B
- C. C
- D. D
- E. E

15. Identify the equipment below that can be used to fabricate a part directly from the CAD system.



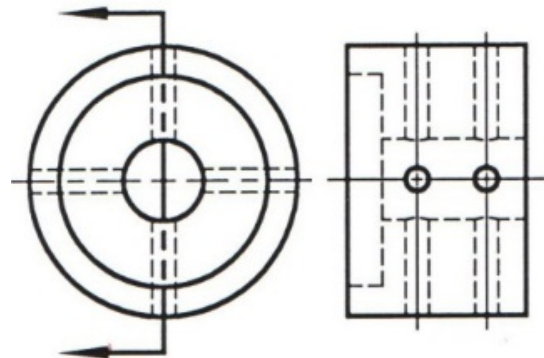
- A. Laminator
- B. 3D printer
- C. Spring fabricator
- D. Sheet metal former
- E. Injection mold

16. What size and tolerance should be applied to the shaft diameter so that the limits of clearance are .010" to .024"?



- A. $.728 \pm .002$
- B. $.726 \pm .001$
- C. $.729 \pm .003$
- D. $.730 \pm .001$
- E. $.725 \pm .002$

17. If the side view of this drawing is converted into a full section view, how many bounded areas will need section lines?



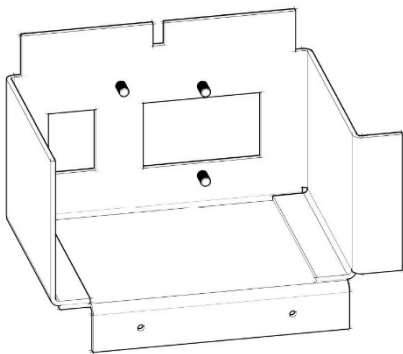
- A. 3
- B. 4
- C. 5
- D. 6
- E. 7

18. Identify a FALSE statement about a #10-32 machine screw. Use the table below if necessary.

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

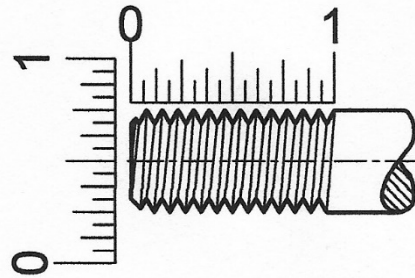
- A. When tapping a hole for these threads, use a No. 25 drill bit
- B. The major diameter is .190"
- C. The thread form is **UNIFIED**
- D. The thread is considered a **FINE** thread
- E. The pitch is 1/32"

19. How many developed pieces of sheet metal will need to be cut (or stamped) to create the object pictured below?



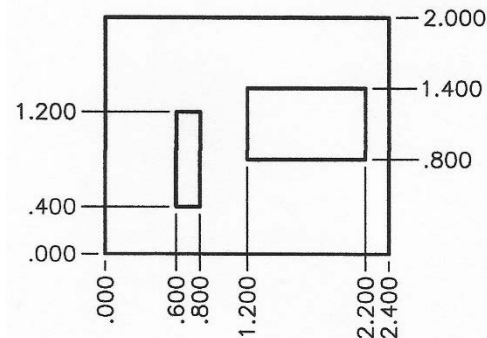
- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

20. What thread note would be correct for the thread illustrated below?



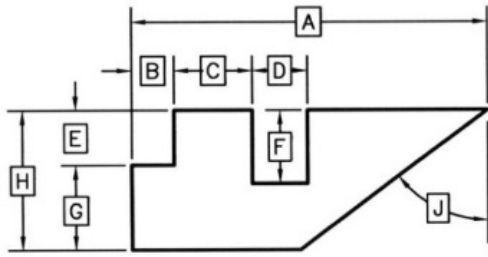
- A. 1/4-32 UNEF-2A
- B. 1/2-13 UNC-2A LH
- C. 3/8-16 UNC-3A DOUBLE
- D. 1/2-12 UNC-2B
- E. 3/4-10 UNC-2B

21. Sometimes referred to as **arrowless dimensioning**, what other ASME term is applied to the method of dimensioning the engineering drawing shown below?



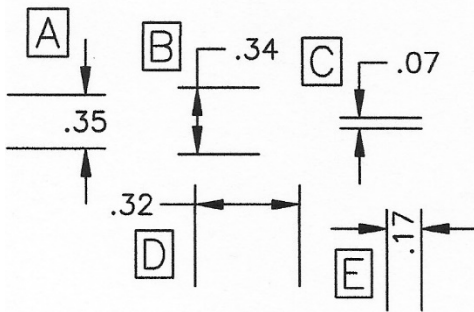
- A. Contour
- B. Chain
- C. Composite
- D. Rectangular Coordinate
- E. Superfluous

22. The object below has too many dimensions. Which of the five dimensions below could be removed?



- A. J
- B. D
- C. G
- D. F
- E. A

23. For small unidirectional dimensions, the dimension line must be treated differently. Which of the following is **not** expressed properly?

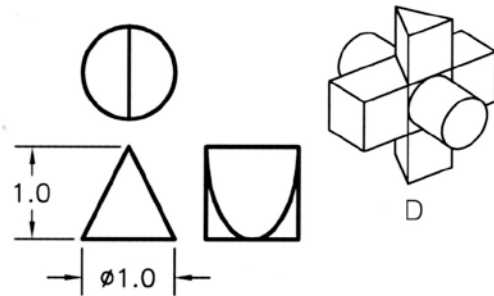
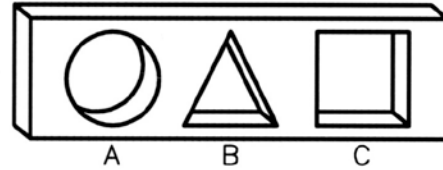


- A. A
- B. B
- C. C
- D. D
- E. E

24. A classic brain teaser asks, "Can one object be designed that can pass through, and fill, each shape illustrated below as A, B, and C?"

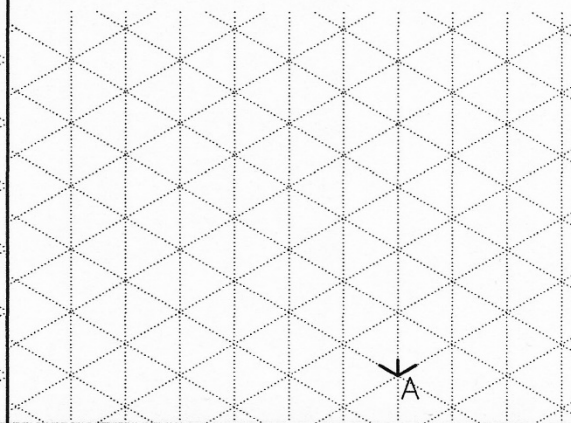
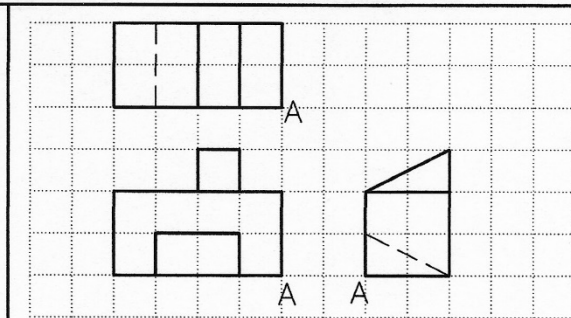
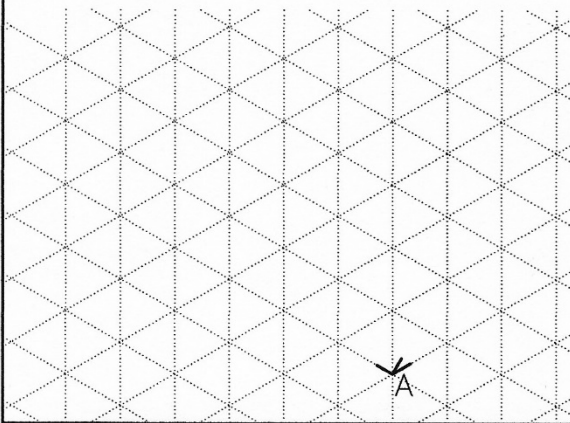
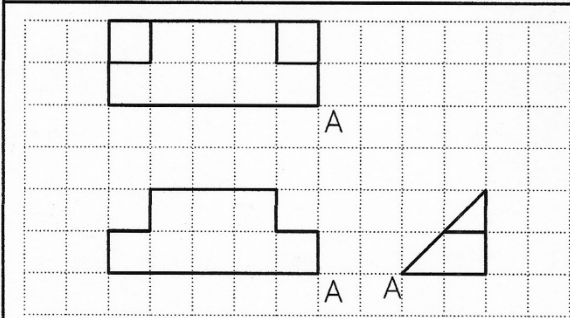
(The solution is shown as a multiview.)

A 3D CAD model of the solution could be modeled by passing three shapes through each other (as shown at D) and using a(n) _____ function.



- A. subtract
- B. intersect
- C. extrude
- D. loft
- E. union

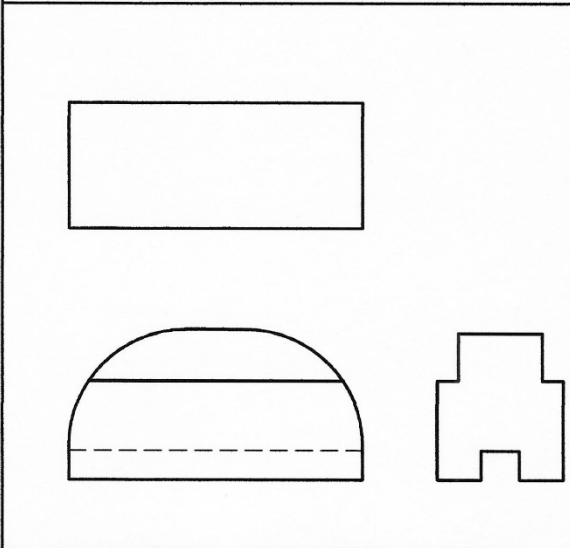
**PROBLEMS 25 & 26: CREATE ISOMETRIC SKETCHES
SELECT AN ANSWER THAT REPRESENTS THE NUMBER OF SEGMENTS REQUIRED**



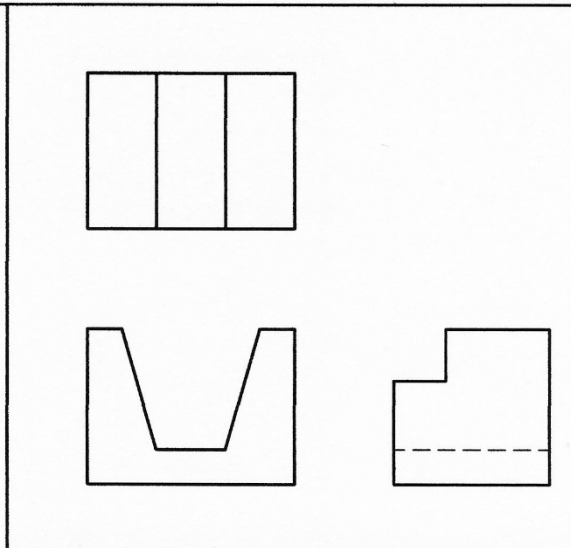
25. NUMBER OF LINE SEGMENTS:
A. 15 B. 16 C. 17 D. 18 E. 19

26. NUMBER OF LINE SEGMENTS:
A. 18 B. 19 C. 20 D. 21 E. 22

**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 COMPLETE A CORRECT AND VALID MULTIVIEW DRAWING**

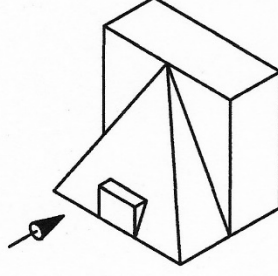
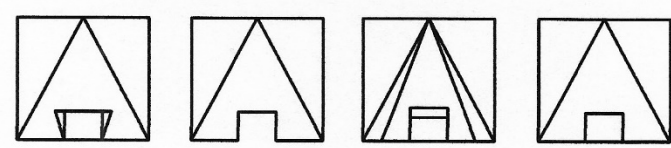
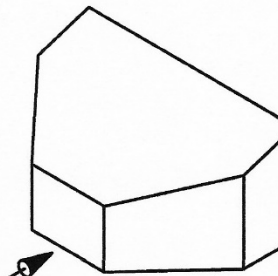
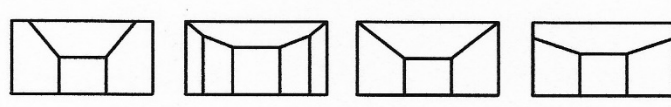
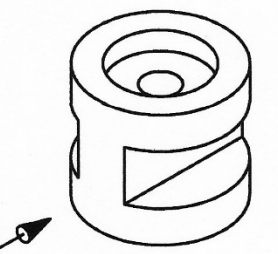
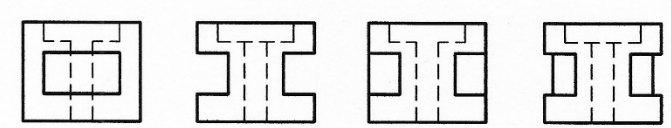
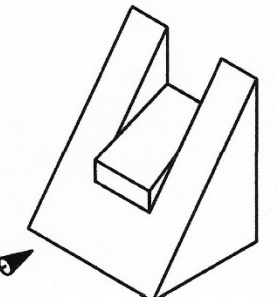
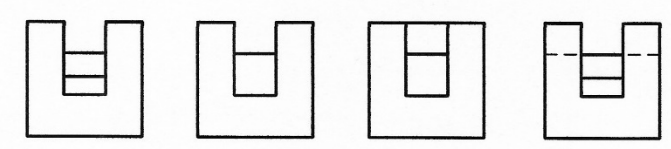


27. MINIMUM NUMBER OF LINES:
A. 4 B. 5 C. 6 D. 7 E. 8

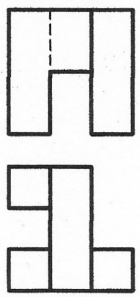
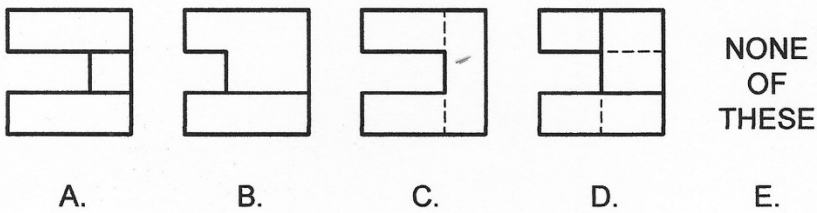
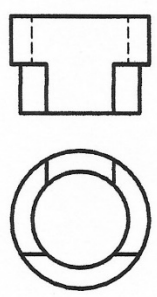
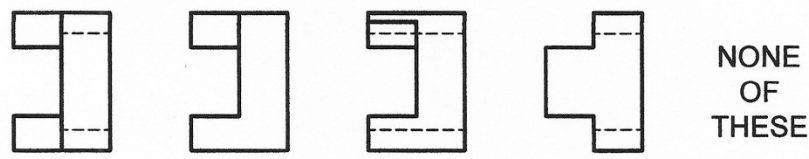
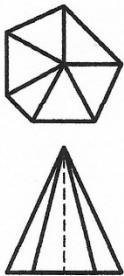
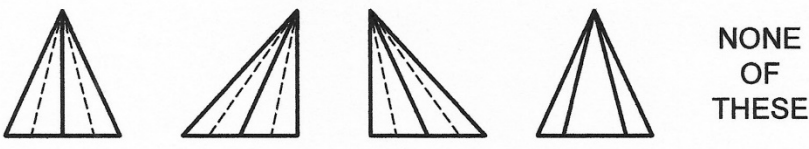
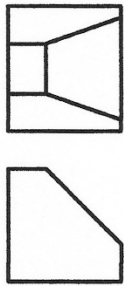
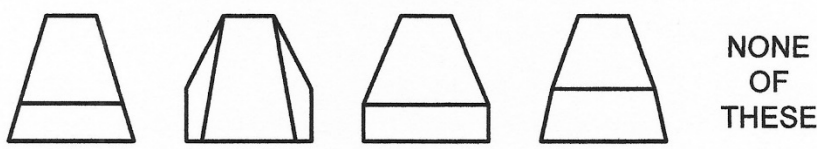


28. MINIMUM NUMBER OF LINES:
A. 5 B. 6 C. 7 D. 8 E. 9

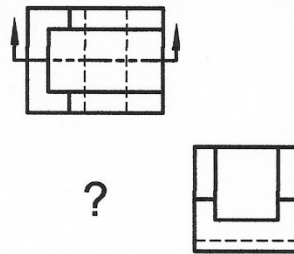

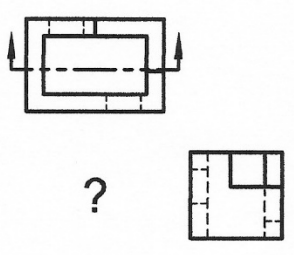
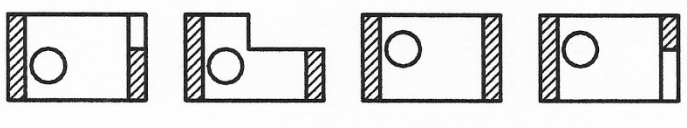
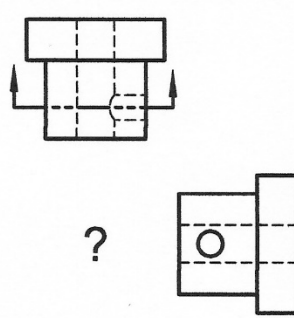
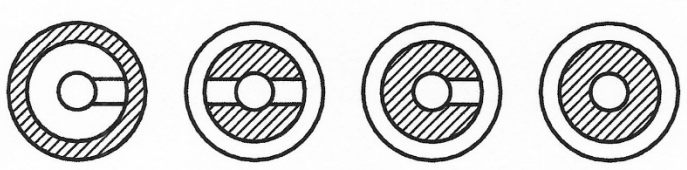
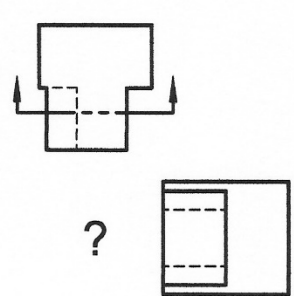
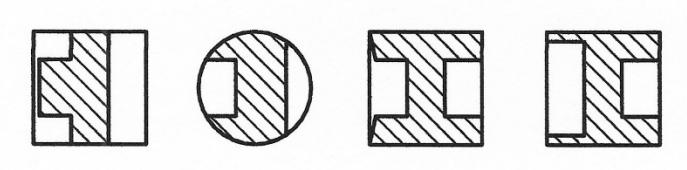
FOR EACH PROBLEM ON THIS PAGE, SELECT A FRONT VIEW
 NOTE: CENTER LINES OMITTED ON THIS TEST

<p>29.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>
<p>30.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>
<p>31.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>
<p>32.</p> 	 <p>A. B. C. D. E. NONE OF THESE</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. B. C. D. E.</p>
<p>34.</p>  <p>?</p>	 <p>A. B. C. D. E.</p>
<p>35.</p>  <p>?</p>	 <p>A. B. C. D. E.</p>
<p>36.</p>  <p>?</p>	 <p>A. B. C. D. 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. E. NONE OF THESE</p>
<p>38.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>
<p>39.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>
<p>40.</p> 	 <p>A. B. C. D. E. NONE OF THESE</p>

Academic Challenge
Engineering Graphics Test (Sectional) – 2022
ANSWER KEY

Question Number	Answer	Question Number	Answer
1.	C	21.	D
2.	D	22.	C
3.	C	23.	E
4.	A	24.	B
5.	B	25.	B
6.	E	26.	C
7.	D	27.	E
8.	E	28.	D
9.	C	29.	D
10.	E	30.	D
11.	C	31.	B
12.	A	32.	A
13.	E	33.	D
14.	E	34.	C
15.	B	35.	A
16.	A	36.	E
17.	D	37.	E
18.	A	38.	B
19.	A	39.	C
20.	B	40.	B