

College Admission IB-Mathematics

IB Mathematics (SL) Examination



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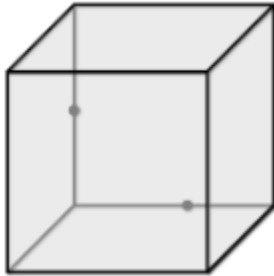
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Question: 1

Identify a possible cross-section polygon NOT formed by a plane containing the given points on the cube.

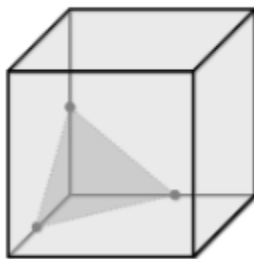


- A. Triangle
- B. Square
- C. Pentagon
- D. Hexagon

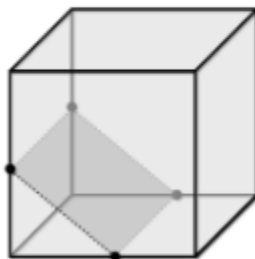
Answer: B

Explanation:

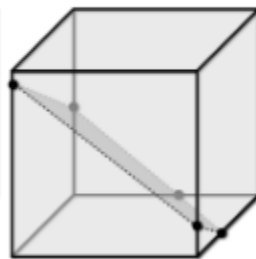
The only cross-section connecting the points that is not possible is a square; a rectangle is possible, but a square is not.



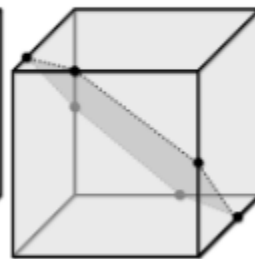
Triangle



Rectangle



Pentagon



Hexagon

Question: 2

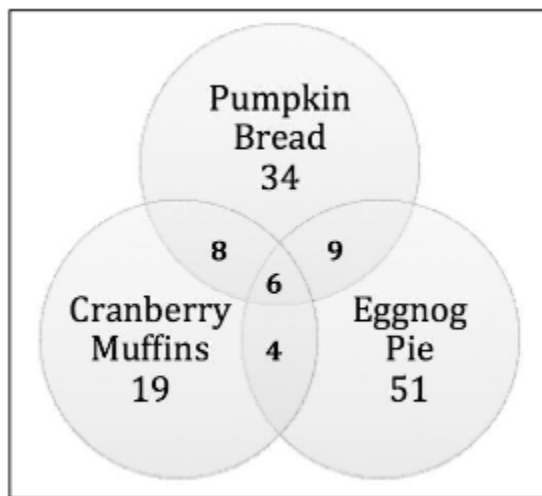
For the holidays, Luke's Bakery offered three seasonal items: pumpkin bread, cranberry muffins, and their famous eggnog pie. They received 57 orders for pumpkin bread, 37 orders for cranberry muffins, and 70 orders for eggnog pie. Fourteen customers ordered both pumpkin bread and cranberry muffins, ten customers ordered both cranberry muffins and eggnog pie, and fifteen customers ordered both pumpkin bread and eggnog pie. Six customers ordered all three items. How many customers placed an order for seasonal items?

- A. 112
- B. 131
- C. 149
- D. 164

Answer: B

Explanation:

Use a Venn diagram to help organize the given information. Start by filling in the space where the three circles intersect: six customers ordered all three items. Now, use that information to fill in the spaces where two circles intersect. For example, fourteen customers ordered both pumpkin bread and cranberry muffins, and six of those were the customers who purchased all three items, so eight customers bought pumpkin bread and cranberry muffins but not eggnog pie. Once the diagram is completed, add the number of orders from each portion of the diagram. The total number of customers was $34 + 19 + 51 + 9 + 8 + 4 + 6 = 131$.



Question: 3

Which of these statements is (are) true for the function $g(x)$?

$$g(x) = \begin{cases} -x + 3 & x < 2 \\ 2x - 1 & x \geq 2 \end{cases}$$

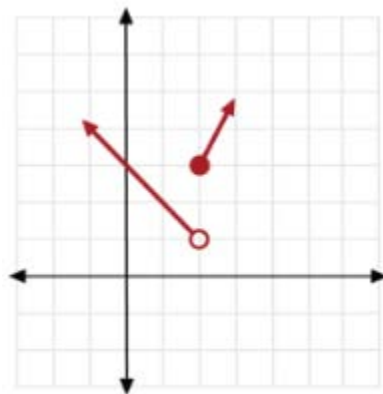
- I. $g(3) = 0$
- II. The graph of $g(x)$ is discontinuous at $x = 2$.
- III. The range of $g(x)$ is all real numbers.

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

Answer: A

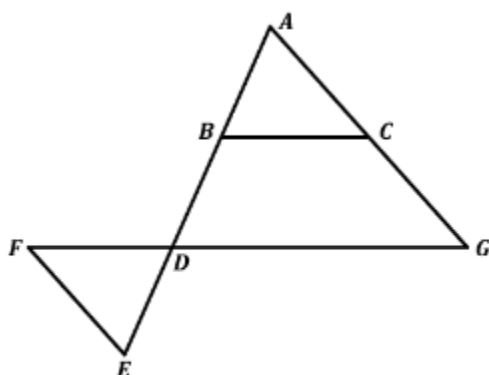
Explanation:

Below is the graph of $g(x)$.



Statement I is true. The graph is discontinuous at $x = 2$. Statement II is false, because $g(3) = 2(3) - 1 = 5$. Statement II is also false because, from the graph, the range of the function is $y > 1$.

Refer to the following for questions 4 - 5:



Given: $\overline{BC} \parallel \overline{FG}$; $\overline{FD} \cong \overline{BC}$; $\overline{AB} \cong \overline{DE}$

Prove: $\overline{FE} \parallel \overline{AG}$

Statement	Reason
1. $\overline{BC} \parallel \overline{FG}$	Given
2.	
3. $\overline{FD} \cong \overline{BC}$	Given
4. $\overline{AB} \cong \overline{DE}$	Given
5. $\triangle ABC \cong \triangle EDF$	_____
6. _____	
7. $\overline{FE} \parallel \overline{AG}$	■

Question: 4

Which of the following justifies step 5 in the proof?

- A. AAS
- B. SSS
- C. ASA
- D. SAS

Answer: D

Explanation:

Since it is given that $\overline{FD} \cong \overline{BC}$ and $\overline{AB} \cong \overline{DE}$, step 2 needs to establish either that $\overline{AC} \cong \overline{EF}$ or that $\triangle ABC \cong \triangle FDE$ in order for step 5 to show that $\triangle ABC \cong \triangle EDF$. The statement $\overline{AC} \cong \overline{EF}$ cannot be shown directly from the given information. On the other hand, $\triangle ABC \cong \triangle FDE$ can be determined: when two parallel lines $\overline{BC} \parallel \overline{FG}$ are cut by a transversal (\overline{AE}), alternate exterior angles ($\angle ABC, \angle FDE$) are congruent. Therefore, $\triangle ABC \cong \triangle EDF$ by the side-angle-side (SAS) theorem.

Question: 5

Step 6 in the proof should contain which of the following statements?

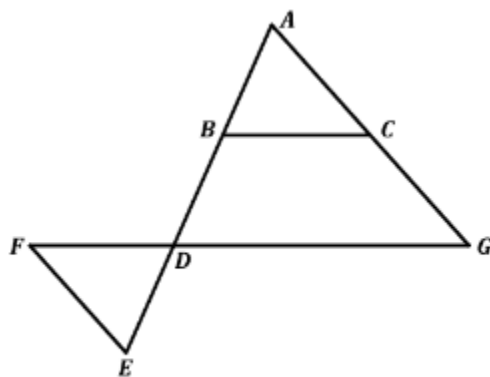
- A. $\angle BAC \cong \angle DEF$
- B. $\angle ABC \cong \angle EDF$
- C. $\angle ACB \cong \angle EFD$
- D. $\angle GDA \cong \angle EDF$

Answer: A

Explanation:

Step 5 established that $\triangle ABC \cong \triangle EDF$. Because corresponding parts of congruent triangles are congruent (CPCTC), $\angle BAC \cong \angle DEF$. This is useful to establish when trying to prove $\overline{FE} \parallel \overline{AG}$: when two lines (\overline{FE} and \overline{AG}) are cut by a transversal (\overline{AE}) and alternate interior angles ($\angle BAC, \angle DEF$) are congruent, then the lines are parallel. The completed proof is shown below:

Statement	Reason
1. $\overline{BC} \parallel \overline{FG}$	Given



Given: $\overline{BC} \parallel \overline{FG}$; $\overline{FD} \cong \overline{BC}$; $\overline{AB} \cong \overline{DE}$
 Prove: $\overline{FE} \parallel \overline{AG}$

2. $\angle ABC \cong \angle FDE$

3. $\overline{FD} \cong \overline{BC}$

4. $\overline{AB} \cong \overline{DE}$

5. $\triangle ABC \cong \triangle EDF$

6. $\angle BAC \cong \angle DEF$

7. $\overline{FE} \parallel \overline{AG}$

Alternate exterior angles of parallel lines are congruent

Given

Given

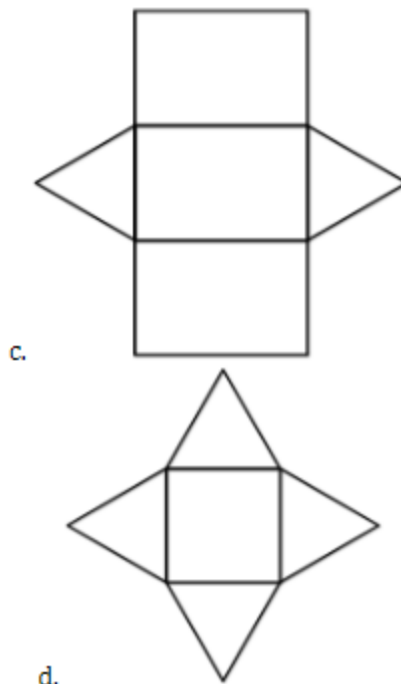
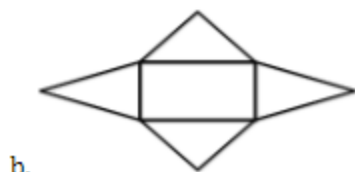
SAS

CPCTC

Alternate interior angles congruent then lines are parallel

Question: 6

Which of these is a net of a triangular pyramid?



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

Answer: A

Explanation:

A triangular pyramid has four triangular faces. The arrangement of these faces in a two-dimensional figure is a net of a triangular pyramid if the figure can be folded to form a triangular pyramid. Choice B represents a rectangular pyramid, choice C is a triangular prism, and choice D is a square pyramid.

Question: 7

What is the exact value of $\tan\left(-\frac{\pi}{4}\right)$?

- A. $\frac{\sqrt{2}}{2}$
- B. $-\frac{\sqrt{2}}{2}$
- C. 1
- D. -1

Answer: D

Explanation:

A coterminal angle for $-\frac{\pi}{4}$ is $2\pi - \frac{\pi}{4} = \frac{7\pi}{4}$.

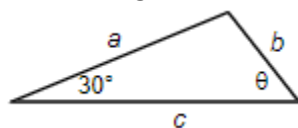
$$\tan\left(-\frac{\pi}{4}\right) = \tan\left(\frac{7\pi}{4}\right) = \frac{\sin\left(\frac{7\pi}{4}\right)}{\cos\left(\frac{7\pi}{4}\right)}$$

From the unit circle, the values of $\sin\left(\frac{7\pi}{4}\right)$ and $\cos\left(\frac{7\pi}{4}\right)$ are $-\frac{\sqrt{2}}{2}$ and $\frac{\sqrt{2}}{2}$, respectively. Therefore:

$$\tan\left(-\frac{\pi}{4}\right) = \frac{-\frac{\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}} = -1$$

Question: 8

In the triangle, which of the following is equal to $\sin \theta$?



- A. $\frac{a}{2b}$
- B. $\frac{a}{2b}$
- C. $\frac{a}{2c}$
- D. $\frac{b}{ac}$

Answer: A

Explanation:

This problem is most easily solved using the law of sines, which states that the ratio of the sine of each angle in a triangle to the length of the opposite side is equal: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$. In this case, angle θ is opposite side a , and the angle with a measure of 30° is opposite side b , so we can write $\frac{\sin \theta}{a} = \frac{\sin 30^\circ}{b}$. Since $\sin 30^\circ = \frac{1}{2}$, this becomes $\frac{\sin \theta}{a} = \frac{\frac{1}{2}}{b}$, or $\sin \theta = \frac{a}{2b}$.

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