

# Mathematics

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## (Chapter – 9) (Propositions and their Converses) (Assignment 5)

(Class – 9)

Name \_\_\_\_\_

Date \_\_\_\_\_

Answer all 15 questions. Choose one option for each MCQ. Show your reasoning wherever asked.

### Section A: Multiple Choice Questions

1. If  $n$  is a prime number, then  $2^n - 1$  is a prime number.  
Which prime value of  $n$  gives a counterexample?  
(a) 2 (b) 3  
(c) 5 (d) 11
2. If a number is a multiple of 3, then it is a multiple of 6.  
Which statement about this proposition is correct?  
(a) It is true for every integer. (b) It is false; 15 is a counterexample.  
(c) It is false; 12 is a counterexample. (d) It is true because 3 divides 6.
3. Fermat claimed that all numbers of the form  $2^{2^n} + 1$  are prime ( $n = 0, 1, 2, 3, \dots$ ); Euler showed that the number for  $n = 5$  is composite. What does this establish?  
(a) All these numbers are composite. (b) All values after  $n = 5$  are prime.  
(c) Fermat's claim is false. (d) Only  $n = 5$  can give a composite.
4. Which set of triangle angles disproves "Every triangle with two acute angles is acute-angled"?  
(a)  $30^\circ, 60^\circ, 90^\circ$  (b)  $40^\circ, 60^\circ, 80^\circ$   
(c)  $50^\circ, 60^\circ, 70^\circ$  (d)  $60^\circ, 60^\circ, 60^\circ$
5. Which statement is the converse of "If a triangle has an angle greater than  $90^\circ$ , it is obtuse-angled"?  
(a) Every triangle is obtuse-angled. (b) Every angle is greater than  $90^\circ$ .  
(c) If it is acute-angled, it is obtuse. (d) If it is obtuse, an angle exceeds  $90^\circ$ .

### Section B: Very Short Answer Questions

6. All numbers of the form  $n^2 + n + 11$  are prime.  
Find a counterexample for a non-negative integer  $n$ .

**Answer:**

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7. Recall that a shortcut to check whether a given number is divisible by 3 is to add the digits of the number and check if the sum is a multiple of 3. Express the relationship between ‘a number is divisible by 3’ and ‘sum of the digits is a multiple of 3’ using ‘If-then’ sentences.

**Answer:**

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8. Let  $\triangle ABC$  be the triangle with sidelengths  $a, b, c$  such that  $a^2 + b^2 = c^2$ .

Construct another right triangle  $\triangle XYZ$  whose perpendicular sides  $YZ$  and  $XZ$  have sidelengths  $a$  and  $b$ .

What can we say about  $\triangle ABC$  and  $\triangle XYZ$ ?

(Hint: Use the SSS criterion for congruence.)

Use  $BC = a$ ,  $CA = b$  and  $AB = c$ , as in the chapter’s diagram.

**Answer:**

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9. For positive integers, is the converse of “If  $n$  is divisible by 16, then  $n$  is divisible by 8” true? Give the smallest counterexample if it is false.

**Answer:**

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10. In the factor-partner argument, consider pairs in which the same factor repeats.

For example, if the number of such pairs is two — say  $(f, f)$  and  $(g, g)$  — what can we say about the number of factors?

**Answer:**

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## Section C: Short and Long Answer Questions

- 11.** We have identified different types of quadrilaterals — squares, rectangles, parallelograms, rhombi, kites and trapezia. One can identify more types (e.g., we could create a category of quadrilaterals that have equal-length opposite sides).

Suppose we have identified a category of quadrilaterals called Q, and we have to construct a quadrilateral of this type. For this, we are to use two thin sticks, put them together as diagonals so that the quadrilateral obtained by joining their endpoints is of type Q (see figure).

The property in part (i) is given for reference:

Suppose Q satisfies the following property.

If a quadrilateral is of type Q, then it has equal-length diagonals.

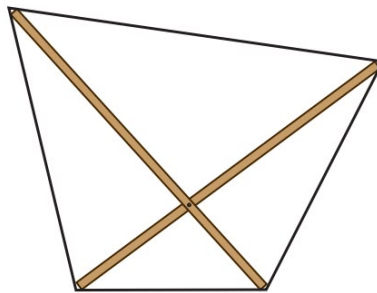
(a) Should the two sticks be of equal length? Why or why not?

(b) Will it matter how the two sticks are put together?

(ii) Instead of the property mentioned above, suppose Q satisfies the following property.

If a quadrilateral has equal diagonals, then it is of type Q.

What will be your answers to (a) and (b) now?



Answer part (ii) only.

**Answer:**

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- 12.** Test both directions of the claim that a positive integer is divisible by 72 exactly when it is divisible by both 8 and 9. Show why checking both divisibilities works here.

**Answer:**

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**Answer:**

**Answer:**

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**Answer:**