

Always, Sometimes, Never

Sort the statements below into Always, Sometimes, Never.

Justifications and proofs are required. If always, prove it. For sometimes state when it is true and when it is not. If Never explain why.

1) Straight lines of the form $y = mx + c$ intersect the x -axis.	2) n odd $\Rightarrow n^2$ even	3) $x > y \Rightarrow x^2 > y^2$
4) If p is prime then $2p + 1$ is also prime	5) $x^2 + y^2 \geq 2xy$ for $x, y \in \mathbb{R}$	6) Non prime integers have an even number of prime factors.
7) If m is odd, n is even then mn is odd.	8) For m, n being consecutive integers $m^2 + n^2$ is odd.	9) $\sqrt{x} < x$
10) Let n, a, b be integers. If n divides a and n divides $a + b$ then n divides b .	11) If n is a square integer then n doesn't end in an 8.	12) For $n \in \mathbb{Z}$ then $n^2 + n + 41$ is prime.

Answers:

- 1) Sometimes
- 2) Never
- 3) Sometimes
- 4) Sometimes
- 5) Always
- 6) Sometimes
- 7) Never
- 8) Always
- 9) Sometimes
- 10) Always
- 11) Always
- 12) Sometimes (first non prime occurs for $n = 40$)