

Task 1 – State whether each of the following are always, sometimes or never true.

- 1) A multiple of 10 is even.
Always (multiples of 10 end in 0)
- 2) The sum of two odd numbers is odd.
Never (odd + odd = even)
- 3) The product of three even numbers is even. **Always**
- 4) The factors of a prime number are all prime.
Never. Prime numbers all have a factor of 1, which is not prime.
- 5) The product of two odd numbers is odd. **Always (odd × odd = odd)**
- 6) A square number is also a cube number. **Sometimes (e.g. $64 = 8^2 = 4^3$)**
- 7) The difference between two square numbers is even. **Sometimes (e.g. $9 - 1 = 8$ even, $16 - 9 = 7$ odd)**
- 8) The sum of three consecutive numbers is a multiple of 3.
 **$n + (n + 1) + (n + 2) = 3n + 3$
Always**
- 9) The quotient of two different even numbers is even.
**($8 \div 2 = 4$ even, $6 \div 2 = 3$ odd)
Sometimes**
- 10) The product of an even number and an odd number is odd.
Never (even × any integer = even)

Task 2

- 11) A is an even number and B is an odd number.

Explain why $3(A + B)$ is always odd.

even + odd = odd

3 is odd

odd × odd = odd

- 12) A is an odd number. Give three examples to support, A^2 is always odd.

Sample answer:

$$1 \times 1 = 1$$

$$3 \times 3 = 9$$

$$5 \times 5 = 25$$

- 13) N is a multiple of 6. Explain why N must also be a multiple of 2 and 3.

6 is divisible by both 2 and 3

- 14) P is a square number and Q is a cube number. Maya says that $P + Q$ is always odd. Give a counterexample example to prove her wrong.

1 is both square and cube

$$1 + 1 = 2 \text{ (even)}$$

Task 3

- 15) A rectangle has integer side lengths. Its area is odd. What can you say about its side lengths?

The side lengths must both be odd

- 16) The sum of two prime numbers is always even. True or false? Give three examples.

False

$$2 + 3 = 5$$

$$3 + 5 = 8$$

$$5 + 7 = 12$$

17) The product of two consecutive even numbers is divisible by 8. Always, sometimes, or never true? Explain.

$$2 \times 4 = 8$$

$$4 \times 6 = 24$$

$$6 \times 8 = 48$$

Always; one number is divisible by 2 and one number is divisible by 4, hence always divisible by 8.

18) The difference between two consecutive integers is always, sometimes or never odd?

$$(n + 1) - n = 1$$

Always

19) A fraction in the form $\frac{\text{odd}}{\text{even}}$ can be simplified to an integer. Always, sometimes, or never?

Never. Odd numbers divided by even numbers will always have a remainder.

20) A sequence is formed by multiplying the prior term by 2. If the first term is odd, explain why every term after will be even.

$$\text{odd} \times 2 = \text{even}$$

$$\text{even} \times 2 = \text{even}$$

Hence, every remaining term will be even.