Introduction to Polynomials for Class 9: Assertion and Reasoning Questions

Directions: In each question below, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q1: Assertion (A): $x^2 + 2x + 1$ is a polynomial in one variable.
Reason (R): An algebraic expression in which the exponents of the variable are whole numbers (non-negative integers) is called a polynomial.
Answer: Option (A)
Explanation: A is true because $x^2 + 2x + 1$ has only whole-number powers of x. R is also true as it correctly defines a polynomial. R explains A, so (a) is correct.

Q2: Assertion (A): A polynomial of degree n has exactly n zeroes.
Reason (R): A linear polynomial has exactly one zero.
Answer: Option (D)
Explanation: A is false: A polynomial of degree n has at most n zeroes (over the reals it can have fewer). For example, $x^2 + 1$ has degree 2 but no real zeroes. R is true: A linear polynomial $ax + b$ ($a \neq 0$) always has exactly one real zero: $x = -b/a$.

Q3: Assertion (A): If $p(2) = 0$ for a polynomial $p(x)$, then $(x - 2)$ is a factor of $p(x)$.
Reason (R): The Remainder Theorem states that when $p(x)$ is divided by $(x - a)$, the remainder is $p(a)$.
Answer: Option (B)
Explanation: A is true as it states the Factor Theorem. R is also true since it correctly states the Remainder Theorem. However, R does not explain A, so (B) is correct.

Q4: Assertion (A): $1/x$ is a polynomial of degree -1.

Reason (R): An expression with a negative integer exponent on the variable is not a polynomial.
Answer: Option (D)
Explanation: A is false because $1/x=x^{-1}$ has a negative exponent, so it is not a polynomial. R is true since polynomials must have only non-negative integer powers of x. Hence, (d) is correct.

Q5: Assertion (A): $x^2 + 5x + 6$ can be factorised as $(x + 2)(x + 3)$.
Reason (R): To factorise $x^2 + bx + c$, find two numbers whose sum equals c and whose product equals b.
Answer: Option (C)
Explanation: A is true since $(x+2)(x+3) = x^2 + 5x + 6$. R is false because the correct rule is sum = b, product = c, not the reverse. Hence, (c) is correct.

Q6: Assertion (A): The degree of $p(x) + q(x)$, where $p(x) = 3x^4 - x^2$ and $q(x) = -3x^4 + 2x$ is 2.
Reason (R): The sum of two polynomials is also a polynomial.
Answer: Option (B)
Explanation: A is true since $p(x)+q(x)=-x^2+2x$, which has degree 2 after cancellation. R is also true because polynomials are closed under addition. However, R does not explain the degree change in A, so (b) is correct.

Q7: Assertion (A): When $p(x) = x^3 - 6x^2 + 2x - 4$ is divided by $(x - 1)$, the remainder is -7.
Reason (R): The Remainder Theorem states that when p(x) is divided by $(x - a)$, the remainder equals p(a).
Answer: Option (A)
Explanation: A is true: $p(1) = 1 - 6 + 2 - 4 = -7$. R is true and is the correct explanation: The Remainder Theorem is what tells us to substitute $x = 1$, giving the remainder directly as $p(1) = -7$.

Q8: Assertion (A): The value of $p(x) = 2x^2 - x + 3$ at $x = -1$ is 6.
Reason (R): The value of a polynomial p(x) at $x = a$ is obtained by substituting a in place of x.
Answer: Option (A)

Solution: A is true: $p(-1) = 2(-1)^2 - (-1) + 3 = 2 + 1 + 3 = 6$. R is true and explains A: The reason describes the method used to find $p(-1)$, and applying that method gives 6.

Q9: Assertion (A):$(x + 2)$ is a factor of $p(x) = x^3 + 2x^2 - x - 2$.
Reason (R):$(x - a)$ is a factor of $p(x)$ if $p(x) = 0$ for all values of x.
Answer: Option (C)
Explanation: A is true since $p(-2)=0$, so $(x+2)$ is a factor. R is false because the Factor Theorem applies at a specific value a, not for all x. Hence, (c) is correct.

Q10: Assertion (A):$2x^2 + 3x$ is a binomial.
Reason (R): A polynomial with exactly two terms is called a binomial.
Answer: Option (A)
Explanation: A is true: $2x^2 + 3x$ has exactly two terms: $2x^2$ and $3x$. R is true and explains A: The definition in R (exactly two terms = binomial) applies directly to the expression in A.