Single Pure – Polynomial Division

Remember

$$\frac{p(x)}{a(x)} \equiv q(x) + \frac{r(x)}{a(x)} \qquad \Leftrightarrow \qquad p(x) \equiv a(x)q(x) + r(x)$$

where
$p(x)$ is the original polynomial,
$a(x)$ is the divisor,
$q(x)$ is the quotient,
$r(x)$ is the remainder.

The order of the quotient is basically what you'd expect. If, for example, you had $\frac{\text{quintic}}{\text{cubic}}$ then the quotient would be a quadratic. The order of the remainder must be *less* than the order of the divisor.

Find the quotient and remainder of the following polynomial divisions:

1. $\dfrac{2x^2 + x - 2}{x^2 + 1}$. — $q(x) = 2, r(x) = x - 4$
2. $\dfrac{x^3}{x^2 + 3x - 1}$. — $q(x) = x - 3, r(x) = 10x - 3$
3. $\dfrac{4x^3 + 1}{x + 5}$. — $q(x) = 4x^2 - 20x + 100, r(x) = -499$
4. $\dfrac{x^3 + 2x^2 + 2x + 4}{x^2 + x + 1}$. — $q(x) = x + 1, r(x) = 3$
5. $\dfrac{x^3 + 2x^2 - x + 1}{x^2 - x - 1}$. — $q(x) = x + 3, r(x) = 3x + 4$
6. $\dfrac{x^5 + x^4 - 3}{x^3 + 2}$. — $q(x) = x^2 + x, r(x) = -2x^2 - 2x - 3$
7. $\dfrac{x^4 + x^3 + x^2 + x + 3}{x^2 - 3x - 2}$. — $q(x) = x^2 + 4x + 15, r(x) = 54x + 33$
8. $\dfrac{x^4 - 4x^2 + 2}{x^2 + 3}$. — $q(x) = x^2 - 7, r(x) = 23$
9. $\dfrac{2x^4}{x^3 - 3x + 1}$. — $q(x) = 2x, r(x) = 6x^2 - 2x$
10. $\dfrac{x^5 - x^4 + x - 2}{x^2 + x + 3}$. — $q(x) = x^3 - 2x^2 - x + 7, r(x) = -3x - 23$
11. $\dfrac{x^6 + x^4 - 2x^2 + 1}{x^4 - 2x^2 + 1}$. — $q(x) = x^2 + 3, r(x) = 3x^2 - 2$
12. $\dfrac{x^5 + 2x^4 + 7x^3 + 7x^2 + 14x + 4}{x^2 + 2x + 4}$. — $q(x) = x^3 + 3x + 1, r(x) = 0$
13. $\dfrac{x^8 + 2x^4 - 1}{x^2 + 3x + 1}$. — $q(x) = x^6 - 3x^5 + 8x^4 - 21x^3 + 57x^2 - 150x + 393, r(x) = -1029x - 394$