The method: Polynomial long division

Divide the leading terms, multiply, subtract, and repeat. Check: divisor × quotient + remainder = dividend.

$(3x^3 - x^2 + 2x - 4) \div (x - 1) = 3x^2 + 2x + 4$

$3x^3 \div x = 3x^2$; subtract $3x^2(x - 1) = 3x^3 - 3x^2$: $2x^2 + 2x - 4$

$2x^2 \div x = 2x$; subtract $2x(x - 1) = 2x^2 - 2x$: $4x - 4$

$4x \div x = 4$; subtract $4(x - 1) = 4x - 4$: 0

$(x - 1)(3x^2 + 2x + 4) = 3x^3 - x^2 + 2x - 4$ check: divisor × quotient + remainder

$(x^3 + 2x^2 - 2x - 1) \div (x^2 - 2) = x + 2$ R 3

$x^3 \div x^2 = x$; subtract $x(x^2 - 2) = x^3 - 2x$: $2x^2 - 1$

$2x^2 \div x^2 = 2$; subtract $2(x^2 - 2) = 2x^2 - 4$: 3

$(x^2 - 2)(x + 2) + 3 = x^3 + 2x^2 - 2x - 1$ check: divisor × quotient + remainder

$(3x^3 + 8x^2 + 3x - 5) \div (3x - 1) = x^2 + 3x + 2$ R -3

$3x^3 \div 3x = x^2$; subtract $x^2(3x - 1) = 3x^3 - x^2$: $9x^2 + 3x - 5$

$9x^2 \div 3x = 3x$; subtract $3x(3x - 1) = 9x^2 - 3x$: $6x - 5$

$6x \div 3x = 2$; subtract $2(3x - 1) = 6x - 2$: -3

$(3x - 1)(x^2 + 3x + 2) + (-3) = 3x^3 + 8x^2 + 3x - 5$

check: divisor × quotient + remainder

Problems 1 and 2 worked out · Version 0A

$(x^3 + 4x^2 + x - 14) \div (x + 2) = x^2 + 2x - 3$ R -8

$x^3 \div x = x^2$; subtract $x^2(x + 2) = x^3 + 2x^2$: $2x^2 + x - 14$

$2x^2 \div x = 2x$; subtract $2x(x + 2) = 2x^2 + 4x$: $-3x - 14$

$-3x \div x = -3$; subtract $-3(x + 2) = -3x - 6$: -8

$(x + 2)(x^2 + 2x - 3) + (-8) = x^3 + 4x^2 + x - 14$

check: divisor × quotient + remainder

$(6x^3 + 3x^2 - 3x + 11) \div (2x + 3) = 3x^2 - 3x + 3$ R 2

$6x^3 \div 2x = 3x^2$; subtract $3x^2(2x + 3) = 6x^3 + 9x^2$: $-6x^2 - 3x + 11$

$-6x^2 \div 2x = -3x$; subtract $-3x(2x + 3) = -6x^2 - 9x$: $6x + 11$

$6x \div 2x = 3$; subtract $3(2x + 3) = 6x + 9$: 2

$(2x + 3)(3x^2 - 3x + 3) + 2 = 6x^3 + 3x^2 - 3x + 11$

check: divisor × quotient + remainder

Answer key

1) $x^2 + 2x - 3$ R -8 2) $3x^2 - 3x + 3$ R 2
3) $x^2 - 3x - 4$ 4) $3x - 5$ R 5 5) $3x - 3$
6) $3x + 6$ R 1 7) $4x^2 - 7$ 8) $2x - 6$
9) $3x - 1$ R -3 10) $4x^2 + 6x + 1$ R 8