

Группировка

$$1) x^3 + x^2 - 4x - 4 = 0$$

$$2) 3x^3 + 5x^2 + 5x + 3 = 0$$

$$3) x^4 + 2x^3 - x - 2 = 0$$

$$4) x^3 - x^2 - 81x + 81 = 0$$

$$5) x^3 + 3x^2 - 16x - 48 = 0$$

$$6) 2x^4 + 3x^3 + 16x + 24 = 0$$

$$7) 24x^4 + 16x^3 - 3x - 2 = 0$$

$$8) x^3 + 5x^2 + 15x + 27 = 0$$

$$9) 8x^3 - 6x^2 + 3x - 1 = 0$$

$$\begin{aligned} x^3 + x^2 - 4x - 4 &= 0; \\ x^2(x+1) - 4(x+1) &= 0; \\ (x^2-4)(x+1) &= 0; \\ (x^2-4) &= 0 \text{ или } (x+1) = 0 \\ x^2-4 &= 0 \\ x^2 &= 4 \\ x &= \pm 2 \\ x &= 2 \\ x &= -2 \\ \text{or} \\ x+1 &= 0 \\ x &= -1 \\ \text{Answer: } &2, -2, -1 \end{aligned}$$

$$\begin{aligned} x^3 + 3x^2 - 16x - 48 &= 0 \\ x^2(x+3) - 16(x+3) &= 0; \\ (x^2-16)(x+3) &= 0; \\ (x^2-16) &= 0 \text{ or } (x+3) = 0; \\ x^2-16 &= 0 \\ x^2 &= 16 \\ x &= \pm 4 \\ x &= 4 \\ x &= -4 \\ \text{or} \\ x+3 &= 0 \\ x &= -3 \\ \text{Answer: } &4; -4; -3 \end{aligned}$$

$$\begin{aligned} 24x^4 + 16x^3 - 3x - 2 &= 0 \\ 8x^3(3x+2) - 1(3x+2) &= 0 \\ (8x^3-1)(3x+2) &= 0 \\ (8x^3-1) &= 0 \text{ or } (3x+2) = 0 \\ 3x+2 &= 0 \\ x &= -\frac{2}{3} \\ \text{or} \\ 8x^3-1 &= 0 \\ x^3 &= \frac{1}{8} \\ x &= \frac{1}{2} \\ \text{Answer: } &-\frac{2}{3}; \frac{1}{2} \end{aligned}$$

$$\begin{aligned} x^3 + 5x^2 + 15x + 27 &= 0; \\ x^3+3^3+15x+5x^2 &= 0; \\ (x+3)(x^2-3x+9)+5x(x+3) &= 0; \\ (x+3)(x^2-3x+9+5x) &= 0; \\ (x+3) &= 0 \text{ or } (x^2+2x+9) = 0; \\ x &= -3 \\ \text{or} \\ x^2+2x+9 &= 0; \\ D &= 2^2-4*9 = 4-36 = -32; D < 0; \\ \text{no solutions} \end{aligned}$$



$$3x^3 + 5x^2 + 5x + 3 = 0$$

$$3x^3 + 3 + 5x^2 + 5x = 0$$

$$3(x^3+1) + 5x(x+1) = 0$$

$$3(x+1)(x^2-x+1) + 5x(x+1) = 0$$

$$(x+1)[3(x^2-x+1) + 5x] = 0$$

$$(x+1)[3x^2-3x+3+5x] = 0;$$

$$(x+1)[3x^2+2x+3] = 0;$$

$$(x+1) = 0$$

$$x = -1;$$

or

$$(3x^2+2x+3) = 0$$

$$D = 4 - 4*3*3 = 4 - 36 = -32; D < 0$$

$$x^4 + 2x^3 - x - 2 = 0$$

$$x^3(x+2) - 1(x+2) = 0$$

$$(x^3-1)(x+2) = 0$$

$$(x-1)(x^2+x+1)(x+2) = 0$$

$$(x-1)$$

$$x = 1$$

or

$$(x+2)$$

$$x = -2$$

or

$$(x^2+x+1)$$

$$D = 1 - 4 = -3; D < 0$$

$$\text{Answer: } 1; -2$$

$$x^3 - x^2 - 81x + 81 = 0$$

$$x^3 - x^2 - 81x + 81 = 0$$

$$x^3 - 81x - x^2 + 81 = 0$$

$$x(x^2-81) - 1(x^2-81) = 0$$

$$(x-1)(x^2-81) = 0$$

$$x-1 = 0$$

$$x = 1$$

$$x^2-81 = 0$$

$$x = 9$$

$$x = -9$$

$$\text{Answer: } 1; 9; -9$$

$$2x^4 + 3x^3 + 16x + 24 = 0$$

$$2x^4 + 16x + 3x^3 + 24 = 0$$

$$2x(x^3+8) + 3(x^3+8) = 0$$

$$(2x+3)(x^3+8) = 0$$

$$2x+3 = 0$$

$$x = -\frac{3}{2}$$

$$(x^3+8) = 0$$

$$x = -2$$

$$\text{Answer: } -\frac{3}{2}; -2$$

$$8x^3 - 6x^2 + 3x - 1 = 0$$

$$8x^3 - 1 - 6x^2 + 3x = 0$$

$$1(8x^3-1) - 3x(2x-1) = 0$$

$$1(2x-1)((2x)^2+2x+1) - 3x(2x-1) = 0$$

$$(2x-1)[1*(4x^2+2x+1) - 3x] = 0$$

$$2x-1 = 0$$

$$x = \frac{1}{2}$$

$$4x^2+2x+1-3x =$$

$$= 4x^2-x+1 = 0$$

$$D = 1 - 16 = -15; D < 0$$

$$\text{Answer: } \frac{1}{2}$$

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