

$$1. (3x^2 - x + 1) + (x) \quad 3x^2 + 1$$

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$$2. (6x^3 - 3x + 2) - (7x^3 + 3x + 7) \quad -x^3 - 6x - 5$$
$$-7x^3 - 3x - 7$$

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$$3. (y^2 + 3y^2 + 2) + (y^4 + y^3 - y^2 + 5)$$
$$y^4 + y^3 + 3y^2 + 7$$

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$$4. (4x^4 + x^2) - (x^3 - x^2 - 1)$$
$$4x^4 - x^3 + 2x^2 + 1$$

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5. The cost of producing x units of a product can be modeled by $C(x) = \frac{1}{10}x^3 - x^2 + 25$. Evaluate $C(x)$ for $x = 15$, and describe what the value represents.

$C(15) = 137.50$; the cost of manufacturing 15 units is \$137.50.

$$\frac{1}{10}(15)^3 - (15)^2 + 25$$

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6. $xy(2x^4y + x^2y^2 - 3xy^3)$ $2x^5y^2 + x^3y^3 - 3x^2y^4$

$$2x^5y^2 + x^3y^3 - 3x^2y^4$$

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$$7. (t+3)(2t^2-t+3) \quad 2t^3 + 5t^2 + 9$$

$$\cancel{2t^3} - \cancel{t^2} + \cancel{3t} + \cancel{6t^2} - \cancel{3t} + 9$$

$$\boxed{2t^3 + 5t^2 + 9}$$

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$$8. (x+5)^3 \quad x^3 + 15x^2 + 75x + 125$$

$$(x+5)(x+5)(x+5)$$

$$\rightarrow (x^2+10x+25)(x+5)$$

$$x^3 + 5x^2 + 10x^2 + 50x + 25x + 125$$

$$(x^3 + 125)$$

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9. $(2y + 3)^4$ $16y^4 + 96y^3 + 216y^2 + 216y + 81$

$(2y + 3)(2y + 3)(2y + 3)(2y + 3)$

$4y^2 + 6y + 6y + 9$

$(4y^2 + 12y + 9)(4y^2 + 12y + 9)$

$16y^4 + 48y^3 + 36y^2 + 48y^3 + 144y^2 + 108y + 36y^2 + 108y + 81$

$16y^4 + 96y^3 + 216y^2 + 216y + 81$ $16y^4 + 81$

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10. $(5x^2 - 6x - 8) \div (x - 2)$ $5x + 4$

$x = 2$

$\underline{2} \mid 5 \quad -6 \quad -8$

$\phantom{\underline{2} \mid} $

$\phantom{\underline{2} \mid} 10 \quad 8$

$5x + 4 \mid 0$

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$$11. (2x^3 - 7x^2 + 9x - 4) \div (2x - 1) = x^2 - 3x + 3 + \frac{-1}{2x-1}$$

$$\begin{array}{r} \frac{1}{2} \overline{) 2 \ -7 \ 9 \ -4} \\ \underline{1 \ -3 \ 3} \end{array}$$

$$2x - 1 = 0$$

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

$$\begin{array}{r} 2 \ -6 \ 6 \ | \ -1 \\ \underline{2x^2 - 6x + 6} \end{array} - \frac{1}{2x-1}$$

$$x^2 - 3x + 3$$

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$$11. (2x^3 - 7x^2 + 9x - 4) \div (2x - 1) = x^2 - 3x + 3 + \frac{-1}{2x-1}$$

$$2x - 1 \overline{) 2x^3 - 7x^2 + 9x - 4}$$

$$\begin{array}{r} (-) 2x^3 - x^2 \\ \hline \end{array}$$

$$\begin{array}{r} -6x^2 + 9x \\ \hline \end{array}$$

$$\begin{array}{r} (-) -6x^2 + 3x \\ \hline \end{array}$$

$$\begin{array}{r} 6x - 4 \\ \hline \end{array}$$

$$\begin{array}{r} (-) 6x - 3 \\ \hline \end{array}$$

$$\begin{array}{r} -1 \end{array}$$

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12. Use synthetic substitution to evaluate $x^4 + 3x^3 - x^2 + 2x - 6$ for $x = 3$.

$$(3)^4 + 3(3)^3 - (3)^2 + 2(3) - 6$$

$$= 153$$

$$\begin{array}{r|rrrrr} 3 & 1 & 3 & -1 & 2 & -6 \\ & & 3 & 18 & 51 & 159 \\ \hline & 1 & 6 & 17 & 53 & \underline{\underline{153}} \end{array}$$

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13. $-2x^2 - 6x + 56$

$$-2(x^2 + 3x - 28)$$

$$-2(x + 7)(x - 4)$$

~~$$-2 \cdot 0$$~~

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$$(m+1)(m+5)(m-5)(m^2+25)$$

$$14. (m^5 + m^4) - (625m - 625)$$

$$m^4(m+1) - 625(m+1) \quad x = \begin{matrix} \cdot 1 \\ \pm 5 \end{matrix}$$

$$(m^4 - 625)(m+1)$$

$$(m^2 - 25)(m^2 + 25)(m+1)$$

~~$$(m+5)(m-5)(m^2+25)(m+1)$$~~

$$\sqrt{m^2 - 25}$$

$$m = \pm 5$$

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$$4(x-2)(x^2+2x+4)$$

$$15. 4x^3 - 32$$

$$4(x^3 - 8)$$

$$4(x-2)(x^2+2x+4)$$

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$$8x^3 + 27 \qquad 2^3x^3 + 3^3$$

$$(2x+3)(4x^2 - 6x + 9)$$

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16. Identify the roots of the equation $2x^4 - 9x^3 + 7x^2 + 2x - 2 = 0$. State the multiplicity of each root.

$\frac{-1}{2} \mid$	2	-9	7	2	-2	
		-1	5	-6	2	
\downarrow	2	-10	12	-4	0	
		2	-8	4		
	2	-8	4	0		

$-\frac{1}{2}, 1$ → $2x^2 - 8x + 4$

$x^2 - 4x + 2$

$$\frac{4 \pm \sqrt{(-4)^2 - 4(1)(2)}}{2(1)}$$

$$\frac{4 \pm \sqrt{8}}{2} = \frac{4 \pm 2\sqrt{2}}{2} = 2 \pm \sqrt{2}$$

17. Write the simplest polynomial function with roots of 1, 4, and -5.

$$(x-1)(x-4)(x+5)$$

$$(x^2 - 3x + 4)(x+5)$$

$$\cancel{x^3 - 5x^2 + 4x + 5x^2 - 25x + 20} \qquad x^3 - 21x + 20$$

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