Operations with Polynomials

Emphasis on Dividing Polynomials

Divide each of the following using SYNTHETIC DIVISION:

1. $(x^2 + 7x - 30) \div (x - 3)$

$x - 3 = 0$, $+3 \ +3$, $x = 3$

3 | 1 7 −30

↓ 3 30

1 10 | 0

$x + 10$

2. $(x^2 + 3x - 40) \div (x - 5)$

$x - 5 = 0$, $+5 \ +5$, $x = 5$

5 | 1 3 −40

↓ 5 40

1 8 | 0

$x + 8$

3. $(x^2 - 13x + 12) \div (x - 1)$

$x - 1 = 0$, $+1 \ +1$, $x = 1$

1 | 1 −13 12

↓ 1 −12

1 −12 | 0

$x - 12$

4. $(a^2 + 7x - 11) \div (3 - a)$

$3 - a = 0$, $+a \ +a$, $3 = a$

3 | 1 7 −11

↓ 3 30

1 10 | 19

$a + 10 + \frac{19}{3-a}$

5. $(r^2 + 5x + 7) \div (1 - r)$

$1 - r = 0$, $+r \ +r$, $1 = r$

1 | 1 5 7

↓ 1 6

1 6 | 13

$r + 6 + \frac{13}{1-r}$

6. $(2x^3 - 13x^2 + 26x - 24) \div (x - 4)$

$x - 4 = 0$, $+4 \ +4$, $x = 4$

4 | 2 −13 26 −24

↓ 8 −20 24

2 −5 6 | 0

$2x^2 - 5x + 6$

7. $(x^3 - 4x^2 + 6x - 4) \div (x - 2)$

$x - 2 = 0$, $+2 \ +2$, $x = 2$

2 | 1 −4 6 −4

↓ 2 −4 4

1 −2 2 | 0

$x^2 - 2x + 2$

8. $(2x^3 + 3x^2 - 4x + 15) \div (x + 3)$

$x + 3 = 0$, $-3 \ -3$, $x = -3$

−3 | 2 3 −4 15

↓ −6 9 −15

2 −3 5 | 0

$2x^2 - 3x + 5$

9. $(3x^3 - 8x^2 + 11x - 14) \div (x - 2)$

$x - 2 = 0$, $+2 \ +2$, $x = 2$

2 | 3 −8 11 −14

↓ 6 −4 14

3 −2 7 | 0

$3x^2 - 2x + 7$

10. $(4a^4 + 2a^2 - 4a + 12) \div (a + 2)$

$a + 2 = 0$, $-2 \ -2$, $a = -2$

−2 | 4 0 2 −4 12

↓ −8 16 −36 80

4 −8 18 −40 | 92

$4a^3 - 8a^2 + 18a - 40 + \frac{92}{a+2}$

If # in ⌋ is a fraction...
Then mult everything left of the last # by $\frac{1}{\text{denominator}}$ of the fraction.

11. $(6b^4 - 8b^3 + 12b - 14) \div (b - 2)$

$b-2=0$, $+2\ +2$, $b=2$

2	6	−8	0	12	−14
	↓	12	8	16	56
	6	4	8	28	+42

$6b^3 + 4b^2 + 8b + 28 + \frac{42}{b-2}$

12. $(4y^3 - 6y^2 + 4y - 1) \div (2y - 1)$

$\frac{1}{2}$	4	−6	4	−1
	↓	2	−2	1
	4	−4	2	0

$\frac{1}{2}(4y^2 - 4y + 2) = 2y^2 - 2y + 1$

$2y-1=0$, $+1\ +1$, $\frac{2y}{2} = \frac{1}{2}$, $y = \frac{1}{2}$

13. $(3x^4 - 5x^3 + x^2 + 7x) \div (3x + 1)$

$3x+1=0$, $-1\ -1$, $\frac{3x}{3} = \frac{-1}{3}$, $x = -\frac{1}{3}$

$-\frac{1}{3}$	3	−5	1	7	0
	↓	−1	2	−1	−2
	3	−6	3	6	−2

$\frac{1}{3}(3x^3 - 6x^2 + 3x + 6)$ $x^3 - 2x^2 + x + 2 - \frac{2}{3x+1}$

14. $(8x^4 - 4x^2 + x + 4) \div (2x + 1)$

$2x+1=0$, $-1\ -1$, $\frac{2x}{2} = \frac{-1}{2}$, $x = -\frac{1}{2}$

$-\frac{1}{2}$	8	0	−4	1	4
	↓	−4	2	1	−1
	8	−4	−2	2	3

$\frac{1}{2}(8x^3 - 4x^2 - 2x + 2)$ $4x^3 - 2x^2 - x + 1 + \frac{3}{2x+1}$

15. $(8y^5 - 2y^4 - 16y^2 + 4) \div (4y - 1)$

$4y-1=0$, $+1\ +1$, $\frac{4y}{4} = \frac{1}{4}$, $y = \frac{1}{4}$

$\frac{1}{4}$	8	−2	0	−16	0	4
	↓	2	0	0	−4	−1
	8	0	0	−16	−4	3

$\frac{1}{4}(8y^4 - 16y - 4) = 2y^4 - 4y - 1 + \frac{3}{4y-1}$

16. $(15b^3 + 8b^2 - 21b + 6) \div (5b - 4)$

$5b-4=0$, $+4\ +4$, $\frac{5b}{5} = \frac{4}{5}$, $b = \frac{4}{5}$

$\frac{4}{5}$	15	8	−21	6
	↓	12	16	−4
	15	20	−5	2

$\frac{1}{5}(15b^2 + 20b - 5) = 3b^2 + 4b - 1 + \frac{2}{5b-4}$

17. $(6c^3 - 17c^2 + 6c + 8) \div (3c - 4)$

$3c-4=0$, $+4\ +4$, $\frac{3c}{3} = \frac{4}{3}$, $c = \frac{4}{3}$

$\frac{4}{3}$	6	−17	6	8
	↓	8	−12	−8
	6	−9	−6	0

$\frac{1}{3}(6c^2 - 9c - 6) = 2c^2 - 3c - 2$

18. $(x^2 - 6x - 20) \div (x + 2)$

$x+2=0$, $-2\ -2$, $x = -2$

−2	1	−6	−20
	↓	−2	16
	1	−8	−4

$x - 8 - \frac{4}{x+2}$

19. $(3z^4 - 6z^3 - 9z^2 + 3z - 6) \div (z + 3)$

$z+3=0$, $-3\ -3$, $z = -3$

−3	3	−6	−9	3	−6
	↓	−9	+45	−108	315
	3	−15	36	−105	309

$3z^3 - 15z^2 + 36z - 105 + \frac{309}{z+3}$

20. $(y^5 - 3y^2 - 20) \div (y - 2)$

$y-2=0$, $+2\ +2$, $y = 2$

2	1	0	0	−3	0	−20
	↓	2	4	8	10	20
	1	2	4	5	10	0

$y^4 + 2y^3 + 4y^2 + 5y + 10$