

# 1 整式の計算

## 1.1 掛け算，割り算

問題 1.1 次の  $A$  と  $B$  について， $A \times B$ (積) および  $A \div B$ (商と余り) を計算しなさい。

$$(1) \begin{cases} A = 3x^2 - 2x + 4 \\ B = x - 3 \end{cases}$$

$$(2) \begin{cases} A = 2x^4 - 3x^3 - 6x^2 + 8x + 3 \\ B = x^2 - 2x - 3 \end{cases}$$

$$(3) \begin{cases} A = 4x^4 - 2x^3 + 5x - 6 \\ B = 2x^2 - 3 \end{cases}$$

問題 1.2 次の  $A$  と  $B$  について， $A \times B$ (積) および  $A \div B$ (商と余り) を，問題 1.1 の模範解答の方法で計算しなさい。

$$(1) \begin{cases} A = 5x^2 + 3x - 9 \\ B = x + 2 \end{cases}$$

$$(2) \begin{cases} A = x^4 + x^3 - 2x^2 + 3x + 4 \\ B = x^2 + 3x - 4 \end{cases}$$

$$(3) \begin{cases} A = 2x^4 - 3x^3 - 4x^2 + 7 \\ B = 2x^2 + x - 6 \end{cases}$$

## 1.2 関数の値

問題 1.3  $f(x) = 4x^6 - 6x^5 - 8x^4 - 9x^3 - 5x^2 + 8x + 9$  について，次の値を計算しなさい。

$$(1) f(5)$$

$$(2) f\left(\frac{1}{2}\right)$$

問題 1.4  $f(x) = 2x^6 - 5x^5 + x^4 - 4x^3 + 3x^2 - x + 6$  について，問題 1.3 の模範解答の方法で次の値を計算しなさい。

$$(1) f(3)$$

$$(2) f\left(-\frac{1}{2}\right)$$

### 1.3 模範解答

問題 1.1 係数だけ書くようにすると、見やすいし、早く計算できる。

(1)

$$\begin{array}{r}
 x^3 \quad x^2 \quad x^1 \quad x^0 \\
 \vdots \quad \vdots \quad \vdots \quad \vdots \\
 \phantom{\times} \phantom{3} \phantom{-2} \phantom{4} \leftarrow A \\
 \times \phantom{3} \phantom{-2} \phantom{4} \phantom{1} \phantom{-3} \leftarrow B \\
 \hline
 \phantom{\times} \phantom{3} \phantom{-2} \phantom{4} \phantom{1} \phantom{-3} \phantom{-9} \phantom{6} \phantom{-12} \leftarrow A \times -3 \\
 \phantom{\times} \phantom{3} \phantom{-2} \phantom{4} \phantom{1} \phantom{-3} \phantom{-9} \phantom{6} \phantom{-12} \phantom{3} \phantom{-2} \phantom{4} \leftarrow A \times 1x \\
 \hline
 \phantom{\times} \phantom{3} \phantom{-2} \phantom{4} \phantom{1} \phantom{-3} \phantom{-9} \phantom{6} \phantom{-12} \phantom{3} \phantom{-2} \phantom{4} \phantom{3} \phantom{-11} \phantom{10} \phantom{-12} \leftarrow A \times B
 \end{array}$$

$\therefore 3x^3 - 11x^2 + 10x - 12$

$$\begin{array}{r}
 x^1 \quad x^0 \quad x^2 \quad x^1 \quad x^0 \\
 \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \\
 \phantom{B \rightarrow} \phantom{1} \phantom{-3} \phantom{3} \phantom{7} \leftarrow \text{商} \\
 B \rightarrow 1 \quad -3 \phantom{) } \phantom{3} \phantom{-2} \phantom{4} \leftarrow A \\
 \phantom{B \rightarrow} \phantom{1} \phantom{-3} \phantom{) } \phantom{3} \phantom{-2} \phantom{4} \phantom{3} \phantom{-9} \leftarrow B \times 3x \\
 \hline
 \phantom{B \rightarrow} \phantom{1} \phantom{-3} \phantom{) } \phantom{3} \phantom{-2} \phantom{4} \phantom{3} \phantom{-9} \phantom{7} \phantom{4} \\
 \phantom{B \rightarrow} \phantom{1} \phantom{-3} \phantom{) } \phantom{3} \phantom{-2} \phantom{4} \phantom{3} \phantom{-9} \phantom{7} \phantom{4} \phantom{7} \phantom{-21} \leftarrow B \times 7 \\
 \hline
 \phantom{B \rightarrow} \phantom{1} \phantom{-3} \phantom{) } \phantom{3} \phantom{-2} \phantom{4} \phantom{3} \phantom{-9} \phantom{7} \phantom{4} \phantom{7} \phantom{-21} \phantom{25} \leftarrow \text{余り}
 \end{array}$$

$\therefore 3x + 7 \quad \text{余り } 25$

(2)

$$\begin{array}{r}
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \\
 \times \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{1} \phantom{-2} \phantom{-3} \\
 \hline
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{1} \phantom{-2} \phantom{-3} \phantom{-6} \phantom{9} \phantom{18} \phantom{-24} \phantom{-9} \\
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{1} \phantom{-2} \phantom{-3} \phantom{-6} \phantom{9} \phantom{18} \phantom{-24} \phantom{-9} \phantom{-4} \phantom{6} \phantom{12} \phantom{-16} \phantom{-6} \\
 \hline
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{1} \phantom{-2} \phantom{-3} \phantom{-6} \phantom{9} \phantom{18} \phantom{-24} \phantom{-9} \phantom{-4} \phantom{6} \phantom{12} \phantom{-16} \phantom{-6} \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \\
 \hline
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{1} \phantom{-2} \phantom{-3} \phantom{-6} \phantom{9} \phantom{18} \phantom{-24} \phantom{-9} \phantom{-4} \phantom{6} \phantom{12} \phantom{-16} \phantom{-6} \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{2} \phantom{-7} \phantom{-6} \phantom{29} \phantom{5} \phantom{-30} \phantom{-9}
 \end{array}$$

$\therefore 2x^6 - 7x^5 - 6x^4 + 29x^3 + 5x^2 - 30x - 9$

$$\begin{array}{r}
 \phantom{1} \phantom{-2} \phantom{-3} \phantom{) } \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \\
 1 \quad -2 \quad -3 \phantom{) } \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \\
 \phantom{1} \phantom{-2} \phantom{-3} \phantom{) } \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{2} \phantom{-4} \phantom{-6} \\
 \hline
 \phantom{1} \phantom{-2} \phantom{-3} \phantom{) } \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{2} \phantom{-4} \phantom{-6} \phantom{1} \phantom{0} \phantom{8} \\
 \phantom{1} \phantom{-2} \phantom{-3} \phantom{) } \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{2} \phantom{-4} \phantom{-6} \phantom{1} \phantom{0} \phantom{8} \phantom{1} \phantom{-2} \phantom{-3} \\
 \hline
 \phantom{1} \phantom{-2} \phantom{-3} \phantom{) } \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{2} \phantom{-4} \phantom{-6} \phantom{1} \phantom{0} \phantom{8} \phantom{1} \phantom{-2} \phantom{-3} \phantom{2} \phantom{11} \phantom{3} \\
 \phantom{1} \phantom{-2} \phantom{-3} \phantom{) } \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{2} \phantom{-4} \phantom{-6} \phantom{1} \phantom{0} \phantom{8} \phantom{1} \phantom{-2} \phantom{-3} \phantom{2} \phantom{11} \phantom{3} \phantom{2} \phantom{-4} \phantom{-6} \\
 \hline
 \phantom{1} \phantom{-2} \phantom{-3} \phantom{) } \phantom{2} \phantom{-3} \phantom{-6} \phantom{8} \phantom{3} \phantom{2} \phantom{-4} \phantom{-6} \phantom{1} \phantom{0} \phantom{8} \phantom{1} \phantom{-2} \phantom{-3} \phantom{2} \phantom{11} \phantom{3} \phantom{2} \phantom{-4} \phantom{-6} \phantom{15} \phantom{9}
 \end{array}$$

$\therefore 2x^2 + x + 2 \quad \text{余り } 15x + 9$

(3)

$$\begin{array}{r}
 \phantom{\times} \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \\
 \times \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{2} \phantom{0} \phantom{-3} \\
 \hline
 \phantom{\times} \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{2} \phantom{0} \phantom{-3} \phantom{-12} \phantom{6} \phantom{0} \phantom{-15} \phantom{18} \\
 \phantom{\times} \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{2} \phantom{0} \phantom{-3} \phantom{-12} \phantom{6} \phantom{0} \phantom{-15} \phantom{18} \phantom{8} \phantom{-4} \phantom{0} \phantom{10} \phantom{-12} \\
 \hline
 \phantom{\times} \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{2} \phantom{0} \phantom{-3} \phantom{-12} \phantom{6} \phantom{0} \phantom{-15} \phantom{18} \phantom{8} \phantom{-4} \phantom{0} \phantom{10} \phantom{-12} \phantom{8} \phantom{-4} \phantom{-12} \phantom{16} \phantom{-12} \phantom{-15} \phantom{18}
 \end{array}$$

$\therefore 8x^6 - 4x^5 - 12x^4 + 16x^3 - 12x^2 - 15x + 18$

$$\begin{array}{r}
 \phantom{2} \phantom{0} \phantom{-3} \phantom{) } \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \\
 2 \quad 0 \quad -3 \phantom{) } \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \\
 \phantom{2} \phantom{0} \phantom{-3} \phantom{) } \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{4} \phantom{0} \phantom{-6} \\
 \hline
 \phantom{2} \phantom{0} \phantom{-3} \phantom{) } \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{4} \phantom{0} \phantom{-6} \phantom{-2} \phantom{6} \phantom{5} \\
 \phantom{2} \phantom{0} \phantom{-3} \phantom{) } \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{4} \phantom{0} \phantom{-6} \phantom{-2} \phantom{6} \phantom{5} \phantom{-2} \phantom{0} \phantom{3} \\
 \hline
 \phantom{2} \phantom{0} \phantom{-3} \phantom{) } \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{4} \phantom{0} \phantom{-6} \phantom{-2} \phantom{6} \phantom{5} \phantom{-2} \phantom{0} \phantom{3} \phantom{6} \phantom{2} \phantom{-6} \\
 \phantom{2} \phantom{0} \phantom{-3} \phantom{) } \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{4} \phantom{0} \phantom{-6} \phantom{-2} \phantom{6} \phantom{5} \phantom{-2} \phantom{0} \phantom{3} \phantom{6} \phantom{2} \phantom{-6} \phantom{6} \phantom{0} \phantom{-9} \\
 \hline
 \phantom{2} \phantom{0} \phantom{-3} \phantom{) } \phantom{4} \phantom{-2} \phantom{0} \phantom{5} \phantom{-6} \phantom{4} \phantom{0} \phantom{-6} \phantom{-2} \phantom{6} \phantom{5} \phantom{-2} \phantom{0} \phantom{3} \phantom{6} \phantom{2} \phantom{-6} \phantom{6} \phantom{0} \phantom{-9} \phantom{2} \phantom{3}
 \end{array}$$

$\therefore 2x^2 - x + 3 \quad \text{余り } 2x + 3$

問題 1.2

(1)

$$\begin{array}{r}
 \phantom{\times} \phantom{5} \phantom{3} \phantom{-9} \\
 \times \phantom{5} \phantom{3} \phantom{-9} \phantom{1} \phantom{2} \\
 \hline
 \phantom{\times} 10 \phantom{6} \phantom{-18} \\
 \phantom{\times} 5 \phantom{3} \phantom{-9} \\
 \hline
 \phantom{\times} 5 \phantom{13} \phantom{-3} \phantom{-18}
 \end{array}$$

$\therefore 5x^3 + 13x^2 - 3x - 18$

$$\begin{array}{r}
 \phantom{1} \phantom{2} \phantom{)} \phantom{5} \phantom{-7} \\
 1 \ 2 \ ) \ 5 \ 3 \ -9 \\
 \phantom{1} \phantom{2} \phantom{)} \ 5 \ 10 \\
 \hline
 \phantom{1} \phantom{2} \phantom{)} \phantom{5} \phantom{10} \phantom{-7} \phantom{-9} \\
 \phantom{1} \phantom{2} \phantom{)} \phantom{5} \phantom{10} \phantom{-7} \phantom{-9} \phantom{-7} \phantom{-14} \\
 \hline
 \phantom{1} \phantom{2} \phantom{)} \phantom{5} \phantom{10} \phantom{-7} \phantom{-9} \phantom{-7} \phantom{-14} \phantom{5}
 \end{array}$$

$\therefore 5x - 7$  余り 5

(2)

$$\begin{array}{r}
 \phantom{\times} \phantom{1} \phantom{1} \phantom{-2} \phantom{3} \phantom{4} \\
 \times \phantom{1} \phantom{1} \phantom{-2} \phantom{3} \phantom{4} \phantom{1} \phantom{3} \phantom{-4} \\
 \hline
 \phantom{\times} \phantom{1} \phantom{1} \phantom{-2} \phantom{3} \phantom{4} \phantom{-4} \phantom{-4} \phantom{8} \phantom{-12} \phantom{-16} \\
 \phantom{\times} \phantom{1} \phantom{1} \phantom{-2} \phantom{3} \phantom{4} \phantom{-4} \phantom{-4} \phantom{8} \phantom{-12} \phantom{-16} \phantom{3} \phantom{3} \phantom{-6} \phantom{9} \phantom{12} \\
 \hline
 \phantom{\times} \phantom{1} \phantom{1} \phantom{-2} \phantom{3} \phantom{4} \phantom{-4} \phantom{-4} \phantom{8} \phantom{-12} \phantom{-16} \phantom{3} \phantom{3} \phantom{-6} \phantom{9} \phantom{12} \phantom{1} \phantom{1} \phantom{-2} \phantom{3} \phantom{4} \\
 \hline
 \phantom{\times} \phantom{1} \phantom{4} \phantom{-3} \phantom{-7} \phantom{21} \phantom{0} \phantom{-16}
 \end{array}$$

$\therefore x^6 + 4x^5 - 3x^4 - 7x^3 + 21x^2 - 16$

$$\begin{array}{r}
 \phantom{1} \phantom{3} \phantom{-4} \phantom{)} \phantom{1} \phantom{-2} \phantom{8} \\
 1 \ 3 \ -4 \ ) \ 1 \ 1 \ -2 \ 3 \ 4 \\
 \phantom{1} \phantom{3} \phantom{-4} \phantom{)} \ 1 \ 3 \ -4 \\
 \hline
 \phantom{1} \phantom{3} \phantom{-4} \phantom{)} \phantom{1} \phantom{3} \phantom{-4} \phantom{-2} \phantom{2} \phantom{3} \\
 \phantom{1} \phantom{3} \phantom{-4} \phantom{)} \phantom{1} \phantom{3} \phantom{-4} \phantom{-2} \phantom{2} \phantom{3} \phantom{-2} \phantom{-6} \phantom{8} \\
 \hline
 \phantom{1} \phantom{3} \phantom{-4} \phantom{)} \phantom{1} \phantom{3} \phantom{-4} \phantom{-2} \phantom{2} \phantom{3} \phantom{-2} \phantom{-6} \phantom{8} \phantom{8} \phantom{-5} \phantom{4} \\
 \hline
 \phantom{1} \phantom{3} \phantom{-4} \phantom{)} \phantom{1} \phantom{3} \phantom{-4} \phantom{-2} \phantom{2} \phantom{3} \phantom{-2} \phantom{-6} \phantom{8} \phantom{8} \phantom{-5} \phantom{4} \phantom{8} \phantom{24} \phantom{-32} \\
 \hline
 \phantom{1} \phantom{3} \phantom{-4} \phantom{)} \phantom{1} \phantom{3} \phantom{-4} \phantom{-2} \phantom{2} \phantom{3} \phantom{-2} \phantom{-6} \phantom{8} \phantom{8} \phantom{-5} \phantom{4} \phantom{8} \phantom{24} \phantom{-32} \phantom{-29} \phantom{36}
 \end{array}$$

$\therefore x^2 - 2x + 8$  余り  $-29x + 36$

(3)

$$\begin{array}{r}
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \\
 \times \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \phantom{2} \phantom{1} \phantom{-6} \\
 \hline
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \phantom{-12} \phantom{18} \phantom{24} \phantom{0} \phantom{-42} \\
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \phantom{-12} \phantom{18} \phantom{24} \phantom{0} \phantom{-42} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \\
 \hline
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \phantom{-12} \phantom{18} \phantom{24} \phantom{0} \phantom{-42} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \phantom{4} \phantom{-6} \phantom{-8} \phantom{0} \phantom{14} \\
 \hline
 \phantom{\times} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \phantom{-12} \phantom{18} \phantom{24} \phantom{0} \phantom{-42} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \phantom{4} \phantom{-6} \phantom{-8} \phantom{0} \phantom{14} \phantom{4} \phantom{-4} \phantom{-23} \phantom{14} \phantom{38} \phantom{7} \phantom{-42}
 \end{array}$$

$\therefore 4x^6 - 4x^5 - 23x^4 + 14x^3 + 38x^2 + 7x - 42$

$$\begin{array}{r}
 \phantom{2} \phantom{1} \phantom{-6} \phantom{)} \phantom{2} \phantom{-3} \phantom{-4} \phantom{0} \phantom{7} \\
 2 \ 1 \ -6 \ ) \ 2 \ -3 \ -4 \ 0 \ 7 \\
 \phantom{2} \phantom{1} \phantom{-6} \phantom{)} \ 2 \ 1 \ -6 \\
 \hline
 \phantom{2} \phantom{1} \phantom{-6} \phantom{)} \phantom{2} \phantom{1} \phantom{-6} \phantom{-4} \phantom{2} \phantom{0} \\
 \phantom{2} \phantom{1} \phantom{-6} \phantom{)} \phantom{2} \phantom{1} \phantom{-6} \phantom{-4} \phantom{2} \phantom{0} \phantom{-4} \phantom{-2} \phantom{12} \\
 \hline
 \phantom{2} \phantom{1} \phantom{-6} \phantom{)} \phantom{2} \phantom{1} \phantom{-6} \phantom{-4} \phantom{2} \phantom{0} \phantom{-4} \phantom{-2} \phantom{12} \phantom{4} \phantom{-12} \phantom{7} \\
 \hline
 \phantom{2} \phantom{1} \phantom{-6} \phantom{)} \phantom{2} \phantom{1} \phantom{-6} \phantom{-4} \phantom{2} \phantom{0} \phantom{-4} \phantom{-2} \phantom{12} \phantom{4} \phantom{-12} \phantom{7} \phantom{4} \phantom{2} \phantom{-12} \\
 \hline
 \phantom{2} \phantom{1} \phantom{-6} \phantom{)} \phantom{2} \phantom{1} \phantom{-6} \phantom{-4} \phantom{2} \phantom{0} \phantom{-4} \phantom{-2} \phantom{12} \phantom{4} \phantom{-12} \phantom{7} \phantom{4} \phantom{2} \phantom{-12} \phantom{-14} \phantom{19}
 \end{array}$$

$\therefore x^2 - 2x + 2$  余り  $-14x + 19$

問題 1.3

$f(x)$  を次のように変形すると、楽に計算できる。

$$\begin{aligned}
 f(x) &= 4x^6 - 6x^5 - 8x^4 - 9x^3 - 5x^2 + 8x + 9 \\
 &= (4x - 6)x^5 - 8x^4 - 9x^3 - 5x^2 + 8x + 9 \\
 &= ((4x - 6)x - 8)x^4 - 9x^3 - 5x^2 + 8x + 9 \\
 &= (((4x - 6)x - 8)x - 9)x^3 - 5x^2 + 8x + 9 \\
 &= (((((4x - 6)x - 8)x - 9)x - 5)x^2 + 8x + 9 \\
 &= ((((((4x - 6)x - 8)x - 9)x - 5)x + 8)x + 9
 \end{aligned}$$

かっこを省略すると

$$= 4 \times x - 6 \times x - 8 \times x - 9 \times x - 5 \times x + 8 \times x + 9$$

ただし 左から順に計算する

(1)  $x = 5$

係数	4	-6	-8	-9	-5	8	9	
左下 $\times x$		20	70	310	1505	7500	37540	
		$\downarrow \nearrow$	$\downarrow \nearrow$	$\downarrow \nearrow$	$\downarrow \nearrow$	$\downarrow \nearrow$	$\downarrow \nearrow$	$\downarrow$
上 2 つの和	4	14	62	301	1500	7508	37549	$= f(5)$

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

係数	4	-6	-8	-9	-5	8	9	
左下 $\times x$		2	-2	-5	-7	-6	1	
上 2 つの和	4	-4	-10	-14	-12	2	10	$= f(\frac{1}{2})$

問題 1.4

(1)  $x = 3$

係数	2	-5	+1	-4	+3	-1	+6	
$\times x$		6	3	12	24	81	240	
	2	1	4	8	27	80	246	$= f(3)$

(2)  $x = -\frac{1}{2}$

係数	2	-5	+1	-4	+3	-1	+6	
$\times x$		-1	3	-2	3	-3	2	
	2	-6	4	-6	6	-4	8	$= f(-\frac{1}{2})$