

# Calculus II

## Complex addition/subtraction.

Todor Milev

2019

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v =$$

.

### Example (Subtraction)

$$u - v =$$

.

### Example (Multiplication)

$$u \cdot v =$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = ?$$

### Example (Subtraction)

$$u - v =$$

### Example (Multiplication)

$$u \cdot v =$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v =$$

### Example (Multiplication)

$$u \cdot v =$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = ?$$

### Example (Multiplication)

$$u \cdot v =$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$u \cdot v =$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$u \cdot v = (2 + 3i) \cdot (5 - 7i)$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \end{aligned}$$



Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \end{aligned}$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \end{aligned}$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \end{aligned}$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \\ &= 10 - 14i + 15i - 21i^2 \end{aligned}$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \\ &= 10 - 14i + 15i - 21i^2 \end{aligned}$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \\ &= 10 - 14i + 15i - 21i^2 \end{aligned}$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \\ &= 10 - 14i + 15i - 21i^2 \end{aligned}$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \\ &= 10 - 14i + 15i - 21i^2 \\ &= 10 + i - (-21) \end{aligned}$$



Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \\ &= 10 - 14i + 15i - 21i^2 \\ &= 10 + i - (-21) \end{aligned}$$

Let  $u = 2 + 3i$ ,  $v = 5 - 7i$ .

### Example (Addition)

$$u + v = (2 + 3i) + (5 - 7i) = (2 + 5) + (3 - 7)i = 7 - 4i.$$

### Example (Subtraction)

$$u - v = (2 + 3i) - (5 - 7i) = (2 - 5) + (3 - (-7))i = -3 + 10i.$$

### Example (Multiplication)

$$\begin{aligned} u \cdot v &= (2 + 3i) \cdot (5 - 7i) \\ &= 2 \cdot 5 + 2 \cdot (-7)i + 3i \cdot 5 + 3i(-7i) \\ &= 10 - 14i + 15i - 21i^2 \\ &= 10 + i - (-21) \\ &= 31 + i \end{aligned}$$