

Class 10th Math Exercise No.1.1

$$x = 3, \quad y = 3$$

EXERCISE 1.1

1. Simplify the following:

(i) i^5	(ii) i^{16}	(iii) $(-i)^{-19}$	(iv) $27i^{-26}$
(v) $i^{11} + i^5$	(vi) $(i^4 + i^3 + i^2 + i)^2$	(vii) $\left(\frac{i^8}{i^5}\right)^{-5}$	(viii) $i^{13} \times i^{29}$
2. Write in terms of i .

(i) $2 + \sqrt{-4}$	(ii) $3 - \sqrt{-7}$	(iii) $\frac{2}{5} + \frac{\sqrt{-16}}{5}$	(iv) $\sqrt{2} - \sqrt{-3}$
---------------------	----------------------	--	-----------------------------
3. Find the values of x and y .

(i) $(2x + 5) + (y - 3)i = 1 + 2i$	(ii) $(3x + 2) - (4 - y)i = 5 + 3i$
(iii) $(2 + i)x + (1 - 2i)y = 3 + 4i$	(iv) $(1 - i)x + (2 + i)y = 4 - i$
(v) $(3x - 1) + (2y - 3)i = 8 + 7i$	

Complex Numbers - Step by Step Solutions

Question 1: Simplify the following

(i) i^5

Step 1: Recall that $i^2 = -1$, $i^3 = -i$, $i^4 = 1$

Step 2: $i^5 = i^4 \cdot i = 1 \cdot i = i$

Answer: i

(ii) i^{16}

Step 1: Since $i^4 = 1$, divide 16 by 4

Step 2: $16 \div 4 = 4$ remainder 0

Step 3: $i^{16} = (i^4)^4 = 1^4 = 1$

Answer: 1

(iii) $(-i)^{-19}$

Step 1: $(-i)^{-19} = \frac{1}{(-i)^{19}}$

Step 2: Find $(-i)^{19}$

- $(-i)^1 = -i$
- $(-i)^2 = i^2 = -1$
- $(-i)^3 = (-i)^2 \cdot (-i) = (-1)(-i) = i$
- $(-i)^4 = 1$

Step 3: $19 \div 4 = 4$ remainder 3

Step 4: $(-i)^{19} = (-i)^3 = i$

Step 5: $(-i)^{-19} = \frac{1}{i} = -i$

Answer: $-i$

(iv) $27i^{-26}$

Step 1: $27i^{-26} = \frac{27}{i^{26}}$

Step 2: $26 \div 4 = 6$ remainder 2

Step 3: $i^{26} = i^2 = -1$

Step 4: $\frac{27}{i^{26}} = \frac{27}{-1} = -27$

Answer: -27

(v) $i^{11} + i^5$

Step 1: $11 \div 4 = 2$ remainder 3 $\rightarrow i^{11} = i^3 = -i$

Step 2: $5 \div 4 = 1$ remainder 1 $\rightarrow i^5 = i$

Step 3: $i^{11} + i^5 = -i + i = 0$

Answer: 0

(vi) $(i^4 + i^3 + i^2 + i)^2$

Step 1: $i^4 = 1, i^3 = -i, i^2 = -1, i = i$

Step 2: $i^4 + i^3 + i^2 + i = 1 - i - 1 + i = 0$

Step 3: $(0)^2 = 0$

Answer: 0

(vii) $\left(\frac{i^8}{i^5}\right)^{-5}$

Step 1: $i^8 = (i^4)^2 = 1^2 = 1$

Step 2: $i^5 = i$

Step 3: $\frac{i^8}{i^5} = \frac{1}{i} = -i$

Step 4: $\left(\frac{i^8}{i^5}\right)^{-5} = (-i)^{-5}$

Step 5: $(-i)^{-5} = \frac{1}{(-i)^5}$

Step 6: $(-i)^5 = (-i)^4 \cdot (-i) = 1 \cdot (-i) = -i$

Step 7: $\frac{1}{-i} = i$

Answer: i

(viii) $i^{13} \times i^{29}$

Step 1: $i^{13} \times i^{29} = i^{13+29} = i^{42}$

Step 2: $42 \div 4 = 10$ remainder 2

Step 3: $i^{42} = i^2 = -1$

Answer: -1

Question 2: Write in terms of i

(i) $2 + \sqrt{-4}$

Step 1: $\sqrt{-4} = \sqrt{4 \cdot (-1)} = \sqrt{4} \cdot \sqrt{-1} = 2i$

Step 2: $2 + \sqrt{-4} = 2 + 2i$

Answer: $2 + 2i$

(ii) $3 - \sqrt{-7}$

Step 1: $\sqrt{-7} = \sqrt{7 \cdot (-1)} = \sqrt{7} \cdot \sqrt{-1} = i\sqrt{7}$

Step 2: $3 - \sqrt{-7} = 3 - i\sqrt{7}$

Answer: $3 - i\sqrt{7}$

(iii) $\frac{2}{5} + \frac{\sqrt{-16}}{5}$

Step 1: $\sqrt{-16} = \sqrt{16 \cdot (-1)} = 4i$

Step 2: $\frac{2}{5} + \frac{4i}{5} = \frac{2+4i}{5}$

Answer: $\frac{2}{5} + \frac{4}{5}i$ or $\frac{2+4i}{5}$

(iv) $\sqrt{2} - \sqrt{-3}$

Step 1: $\sqrt{-3} = \sqrt{3 \cdot (-1)} = i\sqrt{3}$

Step 2: $\sqrt{2} - \sqrt{-3} = \sqrt{2} - i\sqrt{3}$

Answer: $\sqrt{2} - i\sqrt{3}$

Question 3: Find the values of x and y

(i) $(2x + 5) + (y - 3)i = 1 + 2i$

Step 1: Equate real parts:

$$2x + 5 = 1$$

Step 2: Solve for x:

$$2x = 1 - 5 = -4 \Rightarrow x = -2$$

Step 3: Equate imaginary parts:

$$y - 3 = 2$$

Step 4: Solve for y:

$$y = 2 + 3 = 5$$

Answer: $x = -2, y = 5$

(ii) $(3x + 2) - (4 - y)i = 5 + 3i$

Step 1: Rewrite: $(3x + 2) + (-(4 - y))i = 5 + 3i$

$$(3x + 2) + (y - 4)i = 5 + 3i$$

Step 2: Equate real parts:

$$3x + 2 = 53x = 3x = 1$$

Step 3: Equate imaginary parts:

$$y - 4 = 3y = 7$$

Answer: $x = 1, y = 7$

(iii) $(2 + i)x + (1 - 2i)y = 3 + 4i$

Step 1: Expand:

$$2x + ix + y - 2iy = 3 + 4i$$

Step 2: Group real and imaginary parts:

$$(2x + y) + (x - 2y)i = 3 + 4i$$

Step 3: Equate real parts:

$$2x + y = 3 \dots (1)$$

Step 4: Equate imaginary parts:

$$x - 2y = 4 \dots (2)$$

Step 5: Solve the system:

From (1): $y = 3 - 2x$

Substitute in (2):

$$x - 2(3 - 2x) = 4x - 6 + 4x = 45x = 10x = 2$$

Step 6: $y = 3 - 2(2) = 3 - 4 = -1$

Answer: $x = 2, y = -1$

(iv) $(1 - i)x + (2 + i)y = 4 - i$

Step 1: Expand:

$$x - ix + 2y + iy = 4 - i$$

Step 2: Group real and imaginary parts:

$$(x + 2y) + (-x + y)i = 4 - i$$

Step 3: Equate real parts:

$$x + 2y = 4 \dots (1)$$

Step 4: Equate imaginary parts:

$$-x + y = -1 \dots (2)$$

Step 5: Solve the system:

From (2): $y = x - 1$

Substitute in (1):

$$x + 2(x - 1) = 4x + 2x - 2 = 43x = 6x = 2$$

Step 6: $y = 2 - 1 = 1$

Answer: $x = 2, y = 1$

$$(v) (3x - 1) + (2y - 3)i = 8 + 7i$$

Step 1: Equate real parts:

$$3x - 1 = 8$$

Step 2: Solve for x :

$$3x = 9 \Rightarrow x = 3$$

Step 3: Equate imaginary parts:

$$2y - 3 = 7$$

Step 4: Solve for y :

$$2y = 10 \Rightarrow y = 5$$

Answer: $x = 3, y = 5$

Final Answers Summary

1(i)	i
1(ii)	1
1(iii)	$-i$
1(iv)	-27
1(v)	0
1(vi)	0
1(vii)	i
1(viii)	-1
2(i)	$2 + 2i$
2(ii)	$3 - i\sqrt{7}$
2(iii)	$\frac{2}{5} + \frac{4}{5}i$
2(iv)	$\sqrt{2} - i\sqrt{3}$
3(i)	$x = -2, y = 5$
3(ii)	$x = 1, y = 7$
3(iii)	$x = 2, y = -1$
3(iv)	$x = 2, y = 1$
3(v)	$x = 3, y = 5$