

Complex Numbers: math test solutions, Grade 11 – download the PDF

Test solutions with the detailed point scale. Add up your points and spot what to review.

Suggested time: 45 minutes. Out of 20 points. Calculator allowed only when the problem says so.

1 Radicals and powers of i

/ 4 pts

- a. $\sqrt{-98} = i\sqrt{49 \cdot 2} = 7i\sqrt{2}$. (1 pt)
- b. $58 = 4 \cdot 14 + 2$, so $i^{58} = -1$. (1 pt)
- c. $83 = 4 \cdot 20 + 3$, so $i^{83} = -i$. (1 pt)
- d. $i^7 \cdot i^{12} = i^{19}$, and $19 = 4 \cdot 4 + 3$, so the result is $-i$. (1 pt)

2 Operations

/ 4 pts

- a. $5 + 5i$. (1 pt)
- b. $(6 - 4) + (1 + 5)i = 2 + 6i$. (1 pt)
- c. $6 + 15i - 8i - 20i^2 = 6 + 7i + 20 = 26 + 7i$. (1 pt)
- d. $16 - 24i + 9i^2 = 16 - 24i - 9 = 7 - 24i$. (1 pt)

3 Quotients

/ 3 pts

a. Multiply by $3 + i$: $\frac{10(3 + i)}{9 + 1} = \frac{30 + 10i}{10} = 3 + i$. (1 pt)

b. Multiply by $1 - 2i$: numerator $11 - 22i + 2i - 4i^2 = 15 - 20i$ (1 pt); denominator $1 + 4 = 5$; result $3 - 4i$. (1 pt)

4 Quadratic equations

/ 4 pts

a. $x^2 = -75$, so $x = \pm i\sqrt{25 \cdot 3} = \pm 5i\sqrt{3}$. (1 pt)

b. Discriminant: $64 - 100 = -36$ (1 pt). $x = \frac{8 \pm 6i}{2} = 4 \pm 3i$. (1 pt)

c. Sum: $(4 + 3i) + (4 - 3i) = 8 = -\frac{b}{a}$; product: $16 + 9 = 25 = \frac{c}{a}$. (1 pt)

5 Complex plane

/ 3 pts

a. $|z_1| = \sqrt{9 + 16} = 5$. (1 pt)

b. $\overline{z_2} = 2 + i$; it is the mirror image of z_2 across the real axis. (1 pt)

c. $z_1 - z_2 = -5 + 5i$, so the distance is $\sqrt{25 + 25} = 5\sqrt{2} \approx 7.07$. (1 pt)

6 Find the number

/ 2 pts

Divide: $a + bi = \frac{7 - 4i}{1 - 2i} = \frac{(7 - 4i)(1 + 2i)}{1 + 4}$. (1 pt)

Numerator: $7 + 14i - 4i - 8i^2 = 15 + 10i$, so $a + bi = 3 + 2i$. (1 pt)



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