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VCE Specialist Mathematics ½

Complex Numbers I [8.1]

Test

29.5 Marks. 1 Minute Reading. 24 Minutes Writing.

Results:

Test Questions	_____ / 23.5
Extended Test Questions	_____ / 6

Section A: Test Questions (23.5 Marks)

Question 1 (4.5 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. -9 is not a complex number.		
b. The imaginary part of $z = -5 + 6i$ is $6i$.		
c. $\text{Arg}(2 - 3i) = -\tan^{-1}\left(\frac{3}{2}\right)$.		
d. To add/subtract two complex numbers from each other, we simply have to add/subtract their real and imaginary parts.		
e. To divide two complex numbers, we simply have to divide their real and imaginary parts.		
f. For any complex number to be a real number, its argument must be a multiple of π.		
g. If you multiply any complex number by i 10 times, it becomes the negative number of itself.		
h. $z + \bar{z} = 2\text{Re}(z)$.		
i. $z - \bar{z} = \text{Re}(z)$.		

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Question 2 (2 marks)

Express each of the following in their simplest term.

a. $\sqrt{-175}$. (1 mark)

_____

_____

b. $\sqrt{2}\left(\sqrt{-50}+\sqrt{5}\right)$. (1 mark)

_____

_____

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Question 3 (2 marks)

If $z = 2 - 3i$, then find z^2.

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Question 4 (3 marks)

Simplify: $\frac{1-2i}{3+4i} - \frac{2+i}{5i}$.

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Question 5 (2 marks)

Find the conjugate of $z_1 - z_2$ if $z_1 = 2 + 3i$ and $z_2 = 5 + 2i$.

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Question 6 (1 mark)

Simplify: i^{59}.

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Question 7 (3 marks)

Suppose $z = 1 + \sqrt{3}i$ and $\frac{w}{z} = 2 + 2i$.

Find the exact value of the modulus of w and the exact value of the argument of w.

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Question 8 (3 marks)

Let $z = 1 - i$.

Find the value of z^6.

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Question 9 (3 marks)

Consider the complex number $z = 4 + 4i$.

Find the value(s) of k such that z^k is a negative imaginary number.

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Section B: Extended Test Questions (6 Marks)

Question 10 (6 marks)

a. Show that $\frac{4\sqrt{2}+4\sqrt{2}i}{\sqrt{3}+i} = \sqrt{6}+\sqrt{2}+(\sqrt{6}-\sqrt{2})i$. Do NOT use polar form. (2 marks)

b. By converting the numerator and denominator to polar form, express $\frac{4\sqrt{2}+4\sqrt{2}i}{\sqrt{3}+i}$ in polar form. (2 marks)

c. Hence, find the values of $\sin\left(\frac{\pi}{12}\right)$ and $\cos\left(\frac{\pi}{12}\right)$. (2 marks)

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