



Solutions

2.1 Basic Arithmetic

1.
 - i. $10 + 4i$
 - ii. $2 + 2i$
 - iii. $24 + 9i$
 - iv. $-20 - 11i$
2.
 - i. $-7 + 6i$
 - ii. $11 - 3i$
 - iii. $22 - 15i$
 - iv. $-31 + 24i$

2.2 Modulus and Argand Diagram

1.
 - i. 5
 - ii. 10
 - iii. 17
 - iv. 13
 - v. $2\sqrt{2}$
 - vi. $\sqrt{2}$
 - vii. $2\sqrt{5}$
2.
 - i. 5
 - ii. 18
 - iii. $2\sqrt{17}$
 - iv. 8
 - v. $8\sqrt{5}$
3. $k = \pm 12$
4. $k = \pm 8$
5.
 - (a) $|z_1| = 25$
 - (b) $k = \pm 20$
6. $k = \pm 9$
7. .
8. $l = \pm 24$

2.3 Multiplication

1.
 - i. $8 - 6i$
 - ii. $2 + 5i$
 - iii. $-12 + 6i$
 - iv. $41 - i$
 - v. $37 + 9i$
 - vi. 25
 - vii. $9 - 3i$
2.
 - i. $-1 + 2i$
 - ii. .
 - iii. Rotation 90° anticlockwise.
3.
 - i. $4 + 3i$
 - ii. .
 - iii. Rotation 90° clockwise.
4.
 - i. $33 + 56i$
 - ii. $|z_1| = 5, |z_2| = 13, |z_1 z_2| = 65$
 - iii. No.
 - iv. Yes.

2.4 Conjugate

1.
 - i. $3 - 2i$
 - ii. $4 + 5i$
 - iii. 6
 - iv. 8
 - v. 13
 - vi. 41
2.
 - i. $\bar{z}_1 = 1 - 3i, \bar{z}_2 = -2 + i$
 - ii. $-1 - 2i$
 - iii. $-1 - 2i$
 - iv. 2
 - v. 5





2.5 Division

1. i. $2 + i$
 ii. $4 - 3i$
 iii. $2 + 3i$
 iv. $-2 - 6i$
 v. $\frac{5}{3} + 2i$
2. i. $2 + i$
 ii. $1 + i$
 iii. $-2 + 3i$
 iv. $2 - i$
 v. $3 + 2i$
 vi. $-1 - i$
 vii. $\frac{1}{10} + \frac{13}{10}i$

2.6 Equations with Complex roots

1. $-1 \pm 2i$
2. $-3 \pm 2i$
3. $-\frac{3}{4} \pm \frac{\sqrt{23}}{4}i$
4. $k = 4, z = -2 - i$
5. $z = 2, z = -2 + i, z = -2 - i$
6. $z = -3, z = 2 + 3i, z = 2 - 3i$
7. $z = 3, z = -1 - i$
8. $z = 3 + 2i, z = -3 - 2i$
9. $z = \pm(1 - 4i)$
10. $z = 1 + i$
11. $k = -2, z = 3 + 2i$
12. $z = -4, z = 1 + i$

2.7 Polar Form

1. i. $\sqrt{2}(\cos \frac{\pi}{4} + i \sin \frac{\pi}{4})$
 ii. $\sqrt{8}(\cos \frac{7\pi}{4} + i \sin \frac{7\pi}{4})$
 iii. $2(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3})$
 iv. $\sqrt{12}(\cos \frac{7\pi}{6} + i \sin \frac{7\pi}{6})$
 v. $6(\cos \pi + i \sin \pi)$
 vi. $8(\cos \frac{\pi}{2} + i \sin \frac{\pi}{2})$
 vii. $1(\cos \frac{2\pi}{3} + i \sin \frac{2\pi}{3})$
2. i. $\sqrt{2}(\cos \frac{\pi}{4} + i \sin \frac{\pi}{4})$
 ii. $4(\cos \frac{5\pi}{3} + i \sin \frac{5\pi}{3})$
3. i. $6i$
 ii. $2 + 2\sqrt{3}i$

2.8 De Moivre's Theorem

1. i. $-8i$
 ii. -64
 iii. 8
 iv. 1
 v. $-5 - 24i$
 vi. -4096

2.9 Finding the n^{th} root

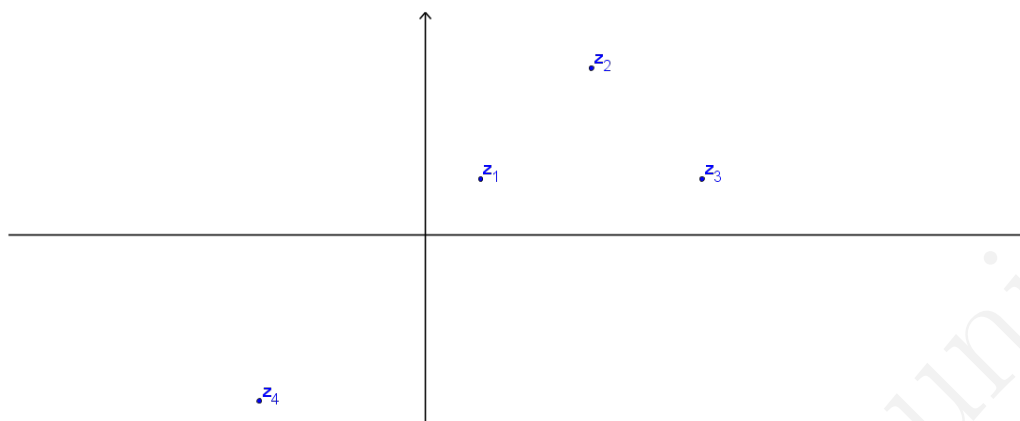
1. $\frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{\sqrt{2}}i$ and $-\frac{1}{\sqrt{2}} - \frac{\sqrt{3}}{\sqrt{2}}i$
2. $2i, -\sqrt{3} - i, \sqrt{3} - i$
3. $\frac{1}{\sqrt{2}} + \frac{\sqrt{3}}{\sqrt{2}}i, -\frac{\sqrt{3}}{\sqrt{2}} + \frac{1}{\sqrt{2}}i, -\frac{1}{\sqrt{2}} - \frac{\sqrt{3}}{\sqrt{2}}i, \frac{\sqrt{3}}{\sqrt{2}} - \frac{1}{\sqrt{2}}i$
4. $1, -\frac{1}{2} + \frac{\sqrt{3}}{2}i, -\frac{1}{2} - \frac{\sqrt{3}}{2}i$
5. $i, -\frac{\sqrt{3}}{2} - \frac{1}{2}i, \frac{\sqrt{3}}{2} - \frac{1}{2}i$
6. $-.6436 + 1.5538i, .6436 - 1.5538i$
7. $3i, -\frac{3\sqrt{3}}{2} - \frac{3}{2}i, \frac{3\sqrt{3}}{2} - \frac{3}{2}i$
8. $1 + i, -1 + i, -1 - i, 1 - i$



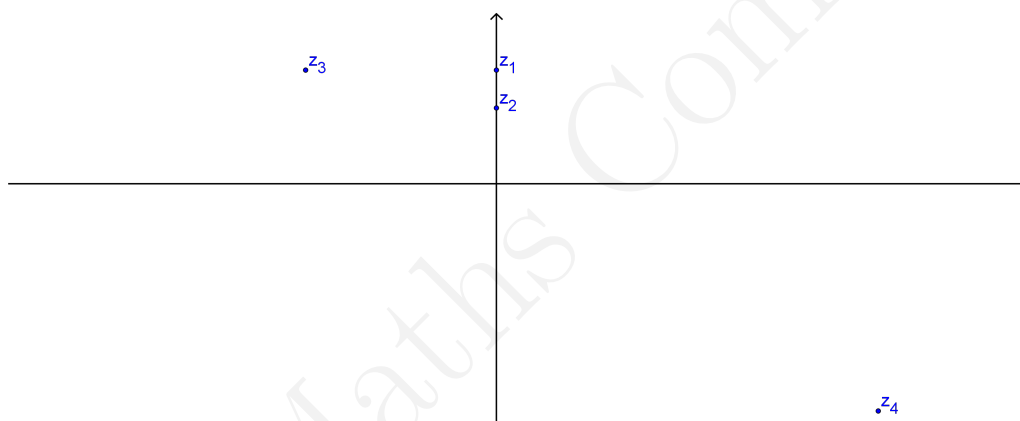


2.10 Argand Diagram

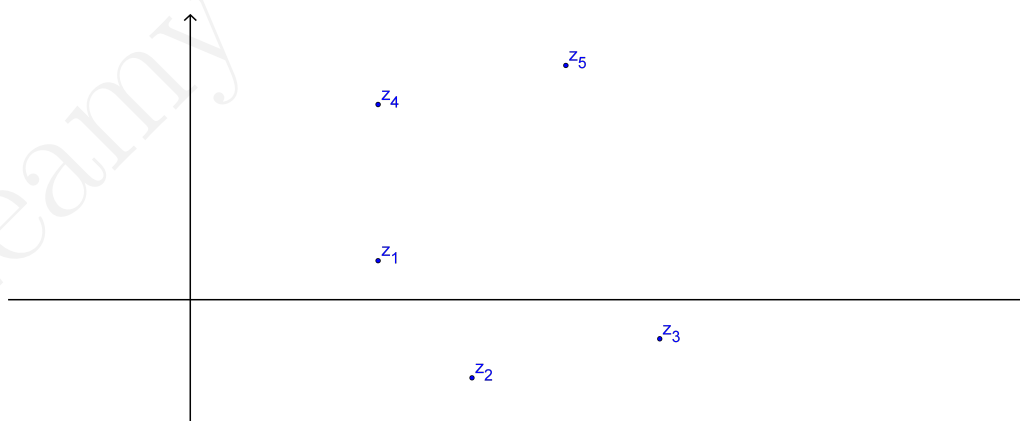
1. .



2. .

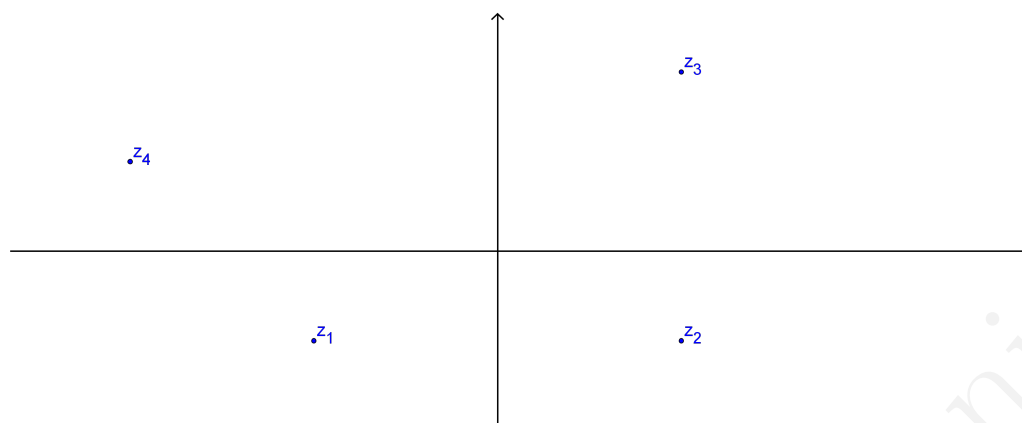


3. .

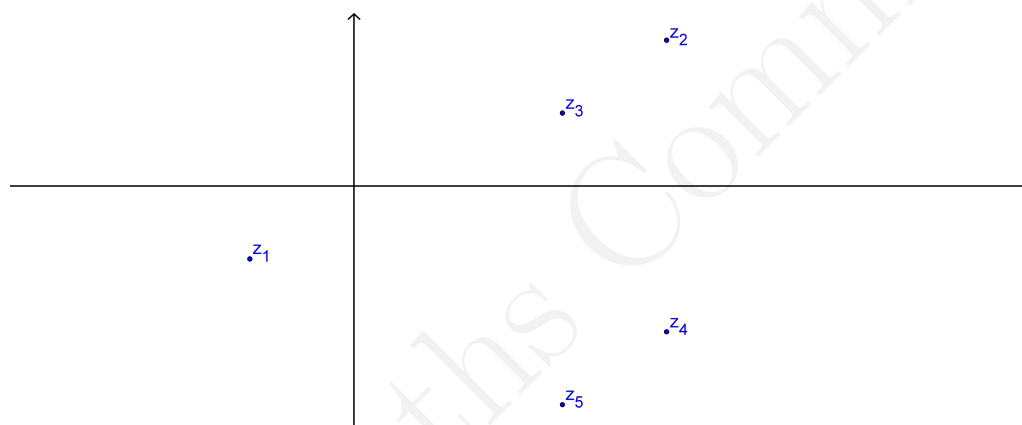




4. .



5. .



2.11 Exam Questions

1. 2016 Paper 1

- (a) $-4 - 3i$
- (b) 16
- (c) $1 - 2i$

2. 2015 Paper 1

- (a) $z_1 = 5 + 1i$
- (b) $S = 0$

3. 2014 Paper 1

- (a) $1 + 2i, \frac{3}{2}$
- (b) i. .
ii. 53°



**4. 2013 Paper 1**

(a) .

(b) $z = 2(\cos \frac{5\pi}{3} + i \sin \frac{5\pi}{3})$

5. 2012 Paper 1

- (a)
- $w_1 = (\frac{3}{2})(\cos \frac{\pi}{9} + i \sin \frac{\pi}{9})$
 - $w_1 = (\frac{3}{2})(\cos \frac{11\pi}{18} + i \sin \frac{11\pi}{18})$
 - $w_1 = (\frac{3}{2})(\cos \frac{10\pi}{9} + i \sin \frac{10\pi}{9})$
 - $w_1 = (\frac{3}{2})(\cos \frac{29\pi}{18} + i \sin \frac{29\pi}{18})$

6. 2011 Paper 1

- (a)
- i. $1 - i = \sqrt{2}(\cos -\frac{\pi}{4} + i \sin -\frac{\pi}{4})$
 - ii. $= 16 - 16i$

