Trigonometric Form of a Complex Number

Precalculus Worksheet · Grade 11-12 · numberbender.com

Name: _____ Date: _____ Score: / 10

Learning Objectives

- Find the absolute value (modulus) of a complex number
- Convert complex numbers from rectangular form to trigonometric form
- Compare distances of complex numbers from the origin

Show all work and express angles in degrees rounded to the nearest tenth when not exact.

1. Find the absolute value of the complex number.

$|3 + 2i|$

Answer: _____

2. Find the absolute value of the complex number.

$|-2 + 5i|$

Answer: _____

3. Between (-2+5i) and (1-6i), which one is closer to the origin? Justify with absolute values.

$|-2 + 5i|$ vs. $|1 - 6i|$

Answer: _____

4. Convert the complex number to trigonometric form (round theta to the nearest tenth of a degree).

$4 + 3i$

Answer: _____

5. For 3-5i, find its absolute value and convert it to trigonometric form (round theta to the nearest tenth).

$3 - 5i$

Answer: _____

6. Convert the complex number to trigonometric form.

$1 + i$

Answer: _____

7. Convert the complex number to trigonometric form.

$-2 + 2\sqrt{3}\,i$

Answer: _____

Scan to watch

8. Convert the complex number to trigonometric form.

$-3 - 3i$

Answer: _____

9. Find the absolute value of the complex number.

$|6 - 8i|$

Answer: _____

10. Convert the complex number to trigonometric form (round theta to the nearest tenth).

$5 - 12i$

Answer: _____

Trigonometric Form of a Complex Number

Precalculus Worksheet · Grade 11-12 · numberbender.com

ANSWER KEY & SOLUTIONS

Remind students that r = sqrt(a^2 + b^2) and tan(theta) = b/a, with attention paid to the correct quadrant for theta.

Solutions

1. Find the absolute value of the complex number.

$|3 + 2i|$

→ *Use the formula |a+bi| = sqrt(a² + b²).*
→ *Substitute a = 3 and b = 2 to get sqrt(9 + 4).*
→ *Simplify to sqrt(13).*

Answer: $\sqrt{13}$

---

2. Find the absolute value of the complex number.

$|-2 + 5i|$

→ *Apply |a+bi| = sqrt(a² + b²).*
→ *Substitute a = -2 and b = 5 to get sqrt(4 + 25).*
→ *Simplify to sqrt(29).*

Answer: $\sqrt{29}$

---

3. Between (-2+5i) and (1-6i), which one is closer to the origin? Justify with absolute values.

$|-2 + 5i|$ vs. $|1 - 6i|$

→ *Compute |-2+5i| = sqrt(4 + 25) = sqrt(29).*
→ *Compute |1-6i| = sqrt(1 + 36) = sqrt(37).*
→ *Since sqrt(29) < sqrt(37), the point -2+5i is closer to the origin.*

Answer: $-2 + 5i$ is closer since $\sqrt{29} < \sqrt{37}$

---

4. Convert the complex number to trigonometric form (round theta to the nearest tenth of a degree).

$4 + 3i$

→ *Find r = sqrt(4² + 3²) = sqrt(25) = 5.*
→ *Find theta with tan(theta) = 3/4, so theta ≈ 36.9°.*
→ *The point lies in Quadrant I, so theta stays at 36.9°.*
→ *Write 5(cos 36.9° + i sin 36.9°).*

Answer: $5(\cos 36.9^\circ + i\sin 36.9^\circ)$

---

5. For 3-5i, find its absolute value and convert it to trigonometric form (round theta to the nearest tenth).

$3 - 5i$

→ *Compute r = sqrt(3² + (-5)²) = sqrt(9 + 25) = sqrt(34).*
→ *Use tan(theta) = -5/3, giving a reference angle of about 59.1°.*
→ *Since 3-5i lies in Quadrant IV, theta = 360° - 59.1° = 300.9°.*
→ *Write sqrt(34)(cos 300.9° + i sin 300.9°).*

Answer: $\sqrt{34}(\cos 300.9^\circ + i\sin 300.9^\circ)$

Scan to watch

6. Convert the complex number to trigonometric form.

$1 + i$

→ *Find r = sqrt(1² + 1²) = sqrt(2).*
→ *Use tan(theta) = 1/1 = 1, giving theta = 45°.*
→ *The point is in Quadrant I, so theta = 45°.*
→ *Write sqrt(2)(cos 45° + i sin 45°).*

Answer: $\sqrt{2}(\cos 45^\circ + i\sin 45^\circ)$

---

7. Convert the complex number to trigonometric form.

$-2 + 2\sqrt{3}i$

→ *Find r = sqrt((-2)² + (2sqrt(3))²) = sqrt(4 + 12) = sqrt(16) = 4.*
→ *Reference angle: tan■¹(2sqrt(3)/2) = tan■¹(sqrt(3)) = 60°.*
→ *Since the point is in Quadrant II, theta = 180° - 60° = 120°.*
→ *Write 4(cos 120° + i sin 120°).*

Answer: $4(\cos 120^\circ + i\sin 120^\circ)$

---

8. Convert the complex number to trigonometric form.

$-3 - 3i$

→ *Find r = sqrt((-3)² + (-3)²) = sqrt(18) = 3sqrt(2).*
→ *Reference angle: tan■¹(3/3) = 45°.*
→ *Since the point lies in Quadrant III, theta = 180° + 45° = 225°.*
→ *Write 3sqrt(2)(cos 225° + i sin 225°).*

Answer: $3\sqrt{2}(\cos 225^\circ + i\sin 225^\circ)$

---

9. Find the absolute value of the complex number.

$|6 - 8i|$

→ *Apply |a+bi| = sqrt(a² + b²).*
→ *Substitute a = 6 and b = -8 to get sqrt(36 + 64).*
→ *Simplify sqrt(100) = 10.*

Answer: 10

---

10. Convert the complex number to trigonometric form (round theta to the nearest tenth).

$5 - 12i$

→ *Find r = sqrt(5² + (-12)²) = sqrt(169) = 13.*
→ *Reference angle: tan■¹(12/5) ≈ 67.4°.*
→ *Since the point lies in Quadrant IV, theta = 360° - 67.4° = 292.6°.*
→ *Write 13(cos 292.6° + i sin 292.6°).*

Answer: $13(\cos 292.6^\circ + i\sin 292.6^\circ)$