Answers: Introduction to complex numbers

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Summary

Answers to questions relating to the guide on introduction to complex numbers.

*These are the answers to* [*Questions: Introduction to complex numbers*](../questions/qs-introtocomplexnumbers.qmd)*.*

**Please attempt the questions before reading these answers!**

## Q1

For each of the quadratic equations below, identify the variable and the coefficients .

1.1. For , the variable is , and the coefficients are .

1.2. For , the variable is , and the coefficients are .

1.3. For , the variable is , and the coefficients are .

1.4. For , the variable is , and the coefficients are .

1.5. For , the variable is , and the coefficients are .

1.6. For , the variable is , and the coefficients are .

1.7. For , the variable is , and the coefficients are .

1.8. For , the variable is , and the coefficients are .

1.9. For , the variable is , and the coefficients are .

1.10. For , the variable is , and the coefficients are .

1.11. For , the variable is , and the coefficients are .

1.12. For , the variable is , and the coefficients are .

## Q2

2.1. The discriminant of the equation is , and therefore the equation has two distinct real roots.

2.2. The discriminant of the equation is , and therefore the equation has one distinct real root.

2.3. The discriminant of the equation is , and therefore the equation has two distinct real roots.

2.4. The discriminant of the equation is , and therefore the equation has two distinct real roots.

2.5. The discriminant of the equation is , and therefore the equation has no real roots (two distinct complex roots).

2.6. The discriminant of the equation is , and therefore the equation has two distinct real roots.

2.7. The discriminant of the equation is , and therefore the equation has one distinct real root.

2.8. The discriminant of the equation is , and therefore the equation has one distinct real root in . Whether or not it has a real root in depends on whether or not is positive. If is positive, there is exactly one real root ; if is negative, then there are no real roots.

2.9. The discriminant of the equation is , and therefore the equation has no real roots. This is true even with as the variable, as if is complex then must also be complex.

2.10. The discriminant of the equation is , and therefore the equation has no real roots. This is true even with as the variable, as if is complex then must also be complex.

2.11. The discriminant of the equation is , and therefore the equation has two distinct real roots and in . Whether or not it has a real root in depends on whether or not either of the roots is between and . If both and are outside this range, then there are no real roots. If one of or is between and , then there are infinitely many solutions.

2.12. The discriminant of the equation is , and therefore the equation has two distinct real roots and in . The amount of real roots depend on the signs of and .

* If and are both positive, then there are four real roots in . This is because or ; square rooting the positive terms gives the roots in as and . Any other roots must be complex, since you are taking square roots of the negative numbers and .
* If exactly one of and is positive (say ), then there are two real roots in given by . All other roots are complex.
* If both and are negative, then then there are no real roots in .

## Q3

3.1. Rearranging gives . The discriminant of this is , and therefore the equation has two distinct real roots.

3.2. Rearranging gives . The discriminant of this is , and therefore the equation has no real roots (two distinct complex roots).

3.3. Rearranging gives . The discriminant of this is , and therefore the equation has one distinct real root.

3.4. Rearranging gives . The discriminant of this is , and therefore the equation has no real roots. This is true even with as the variable, as if is complex then must also be complex.

3.5. Rearranging gives . The discriminant of this is , and therefore the equation has two distinct real roots.

3.6. Rearranging gives . The discriminant of this is , and therefore the equation has one distinct real root in . Whether or not it has a real root in depends on whether or not is positive. If is positive, there is exactly one real root ; if is negative, then there are no real roots.

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v1.0: initial version created 09/24 by tdhc.

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