The Discriminant

Name: _____	Date: _____	Score: _____ / 24

Quick Review

For a quadratic equation $ax^2 + bx + c = 0$, the **discriminant** is $D = b^2 - 4ac$. It tells you the number and type of solutions before you solve. If $D > 0$, there are two real solutions; if $D = 0$, there is one real solution; if $D < 0$, there are no real solutions. If D is a perfect square, the real solutions are rational; if D is positive but not a perfect square, the real solutions are irrational.

PRACTICE

Find the discriminant and describe the solutions.

1. $x^2 - 5x + 6 = 0$ _____
2. $x^2 + 4x + 4 = 0$ _____
3. $x^2 + x + 1 = 0$ _____
4. $2x^2 - 3x - 2 = 0$ _____
5. $3x^2 + 2x + 5 = 0$ _____
6. $x^2 - 2x - 1 = 0$ _____
7. $4x^2 + 4x + 1 = 0$ _____
8. $5x^2 - x + 2 = 0$ _____
9. $x^2 - 9 = 0$ _____
10. $2x^2 + 7x + 3 = 0$ _____
11. $6x^2 + x + 2 = 0$ _____
12. $9x^2 - 12x + 4 = 0$ _____
13. $x^2 + 6x + 5 = 0$ _____
14. $x^2 + 2x - 3 = 0$ _____
15. $2x^2 + 4x + 7 = 0$ _____
16. $3x^2 - 10x + 2 = 0$ _____
17. $x^2 - 8x + 16 = 0$ _____
18. $7x^2 + 2x - 1 = 0$ _____
19. $x^2 + 5x + 8 = 0$ _____
20. If $D = 49$, describe solutions _____

Word Problems

21. A quadratic model has equation $h(t) = -16t^2 + 32t + 4$. Use the discriminant to decide whether the object reaches ground level.

_____

22. A profit equation is $P(x) = -x^2 + 6x - 12$. Use the discriminant to decide whether profit ever equals zero.

_____

23. A parabola touches the x-axis at exactly one point. What must be true about its discriminant?

_____

24. A quadratic equation has discriminant 18. How many real solutions does it have, and are they rational?

_____

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Answer Keys

1. $D = 1$; two rational
2. $D = 0$; one real
3. $D = -3$; no real
4. $D = 25$; two rational
5. $D = -56$; no real
6. $D = 8$; two irrational
7. $D = 0$; one real
8. $D = -39$; no real
9. $D = 36$; two rational
10. $D = 25$; two rational
11. $D = -47$; no real
12. $D = 0$; one real
13. $D = 16$; two rational
14. $D = 16$; two rational
15. $D = -40$; no real
16. $D = 76$; two irrational
17. $D = 0$; one real
18. $D = 32$; two irrational
19. $D = -7$; no real
20. two rational
21. $D = 1280$; yes, two real times
22. $D = -12$; no real break-even point
23. $D = 0$
24. two real irrational solutions

Step-by-Step Tutor Notes

1. This is a good place to slow down, check the notation, and simplify cleanly. $D = (-5)^2 - 4(1)(6) = 25 - 24 = 1$. So the answer is $D = 1$; two rational.
2. Start with the definition the problem is testing, then apply it directly. $D = 16 - 16 = 0$. So the answer is $D = 0$; one real.
3. Start with the definition the problem is testing, then apply it directly. $D = 1 - 4 = -3$. So the answer is $D = -3$; no real.
4. Start with the definition the problem is testing, then apply it directly. $D = (-3)^2 - 4(2)(-2) = 9 + 16 = 25$. So the answer is $D = 25$; two rational.
5. Start with the definition the problem is testing, then apply it directly. $D = 4 - 60 = -56$. So the answer is $D = -56$; no real.
6. This is a good place to slow down, check the notation, and simplify cleanly. $D = 4 + 4 = 8$, positive but not a perfect square. So the answer is $D = 8$; two irrational.
7. Start with the definition the problem is testing, then apply it directly. $D = 16 - 16 = 0$. So the answer is $D = 0$; one real.
8. Focus on the main idea of the problem, then simplify carefully. $D = 1 - 40 = -39$. So the answer is $D = -39$; no real.
9. This is a good place to slow down, check the notation, and simplify cleanly. Here $a = 1, b = 0, c = -9$, so $D = 36$. So the answer is $D = 36$; two rational.
10. Focus on the main idea of the problem, then simplify carefully. $D = 49 - 24 = 25$. So the answer is $D = 25$; two rational.
11. Use the clue in the question first, then let the arithmetic finish the job. $D = 1 - 48 = -47$. So the answer is $D = -47$; no real.
12. Start with the definition the problem is testing, then apply it directly. $D = 144 - 144 = 0$. So the answer is $D = 0$; one real.
13. This is a good place to slow down, check the notation, and simplify cleanly. $D = 36 - 20 = 16$. So the answer is $D = 16$; two rational.
14. Start with the definition the problem is testing, then apply it directly. $D = 4 + 12 = 16$. So the answer is $D = 16$; two rational.
15. Focus on the main idea of the problem, then simplify carefully. $D = 16 - 56 = -40$. So the answer is $D = -40$; no real.
16. This is a good place to slow down, check the notation, and simplify cleanly. $D = 100 - 24 = 76$. So the answer is $D = 76$; two irrational.
17. Take it one clear step at a time and keep the original question in mind. $D = 64 - 64 = 0$. So the answer is $D = 0$; one real.
18. Focus on the main idea of the problem, then simplify carefully. $D = 4 + 28 = 32$. So the answer is $D = 32$; two irrational.
19. Take it one clear step at a time and keep the original question in mind. $D = 25 - 32 = -7$. So the answer is $D = -7$; no real.
20. Start with the definition the problem is testing, then apply it directly. Positive perfect square means two rational solutions. So the answer is two rational.
21. Set $h = 0$. With $a = -16, b = 32, c = 4$, $D = 32^2 - 4(-16)(4) = 1280 > 0$, so the graph crosses the ground level.
22. Here $a = -1, b = 6, c = -12$. The discriminant is $36 - 48 = -12$, so the model has no real zeros.
23. Touching once means the quadratic has one real solution, which happens exactly when the discriminant is 0.
24. 18 is positive, so there are two real solutions. It is not a perfect square, so the solutions are irrational.

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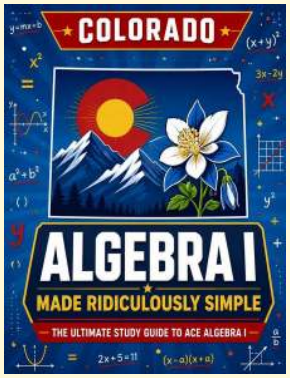

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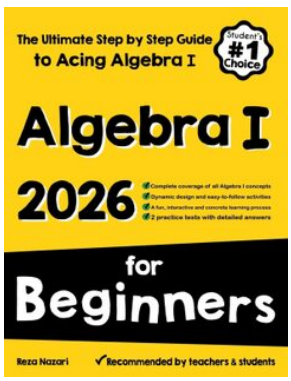

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