MATHS BASEMAKER

Class 10 Mathematics — Chapter 4: Quadratic Equations

Chapter Test Paper

Q1. Which one is not in the form of a quadratic equation?

(a) $(x + 2)(x + 3) = x + 7$ (b) $(x + 2)(x - 2) = 12$

(c) $x(x^2+2x+1)-3=2x^2+ x^3$ (d) $x(2x^2+x-1)=2x^3$

Q2. The value of $\sqrt{(6 + \sqrt{(6 + \sqrt{(6 + ...)})}}$ is:

(a) 4 (b) -2

(c) 3 (d) -3

Q3. If 2 is a root of equation $x^2 + bx + 12 = 0$ and equation $x^2 + bx + q = 0$ has equal roots, then the value of q is:

(a) 8 (b) -8

(c) 16 (d) -16

Q4. If equation $px^2 + 2x + p = 0$ has two equal roots, then:

(a) $p = 1$ (b) $p = 0$

(c) $p = \pm 1$ (d) $p = -1$

Q5. Solve for x: $9x^2 - 3(a + b)x + ab = 0$

Q6. In an optics experiment, a sharp, real image of an object is obtained on a screen using a convex lens of focal length 20 cm. The total distance between the object and the screen is 90 cm. Using the relation $1/x + 1/(90-x) + 1/20$

(a) Form a quadratic equation (b) Find the possible places where the object can be placed

https://youtu.be/9TBGtYX_AEY (video solution)

Q7. If the equation $(m + 1)x^2 + 2(m + 3)x + (2m + 3) = 0$ has equal roots, find the values of m.

Q8. If $(a - b)x^2 + (b - c)x + (c - a) = 0$ has equal roots, prove that $2a = b + c$.

Q9. Q9. The speed of a delivery drone in calm weather is 10 km/h. For a 24 km trip, it takes 1 hour longer against a headwind than returning with a tailwind. Find the speed of the wind.

Q10. Find the positive number which exceeds its square root by 20.

Video solution of this test :

https://youtu.be/9TBGtYX_AEY

HINTS & STEPS

Q1. Solution & Steps

Hint: Expand each expression and check the highest power of x. A quadratic equation must have degree 2.

In option (a): $(x + 2)(x + 3) = x + 7 \Rightarrow x^2 + 5x + 6 = x + 7 \Rightarrow x^2 + 4x - 1 = 0$ (Degree 2)

In option (b): $(x + 2)(x - 2) = 12 \Rightarrow x^2 - 4 = 12 \Rightarrow x^2 - 16 = 0$ (Degree 2)

In option (c): $x(x^2+2x+1)-3=2x^2+ x^3 \Rightarrow x^3 + 2x^2 + x - 3 =2x^2+ x^3$ $(a = 0)$

In option (d): $x(2x + 1) = 0 \Rightarrow 2x^2 + x = 0$ (Degree 2)

Answer: (c) $x(x^2 + 2x + 1) - 3 = 2x^2+ x^3$

Q2. Solution & Steps

Hint: Let $y = \sqrt{(6 + \sqrt{(6 + \sqrt{(6 + ...)})})}$. Squaring both sides gives $y^2 = 6 + y$.

$y^2 - y - 6 = 0$

$(y - 3)(y + 2) = 0$

$y = 3$ or $y = -2$

Since a square root expression must be positive, $y = 3$.

Answer: (c) 3

Q3. Solution & Steps

Hint: Substitute x = 2 into $x^2 + bx + 12 = 0$ to find b, then set Discriminant D = 0 for $x^2 + bx + q = 0$.

$2^2 + b(2) + 12 = 0 \Rightarrow 4 + 2b + 12 = 0 \Rightarrow 2b = -16 \Rightarrow b = -8$

Now, for $x^2 - 8x + q = 0$ to have equal roots: $D = b^2 - 4ac = 0$

$(-8)^2 - 4(1)(q) = 0 \Rightarrow 64 - 4q = 0 \Rightarrow 4q = 64 \Rightarrow q = 16$.

Answer: (c) 16

Q4. Solution & Steps

Hint: For equal roots, Discriminant $D = b^2 - 4ac = 0$.

In $px^2 + 2x + p = 0$: a = p, b = 2, c = p

$D = (2)^2 - 4(p)(p) = 4 - 4p^2 = 0$

$4p^2 = 4 \Rightarrow p^2 = 1 \Rightarrow p = \pm 1$.

Answer: (c) p = ±1

Q5. Solution & Steps

Hint: Split the middle term: $-3(a + b)x = -3ax - 3bx$.

$9x^2 - 3ax - 3bx + ab = 0$

$3x(3x - a) - b(3x - a) = 0$

$(3x - a)(3x - b) = 0$

$3x - a = 0 \Rightarrow x = a/3$ OR $3x - b = 0 \Rightarrow x = b/3$.

Answer: x = a/3 or x = b/3

Q6. Solution & Steps

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ **put the values and get $x^2 - 90x + 1800 = 0$ solving x =30 and 60**

Q7. Solution & Steps

Hint: For equal roots, Discriminant $D = B^2 - 4AC = 0$.

A = m + 1, B = 2(m + 3), C = 2m + 3

$D = [2(m + 3)]^2 - 4(m + 1)(2m + 3) = 0$

$4(m^2 + 6m + 9) - 4(2m^2 + 5m + 3) = 0$

Divide by 4: $(m^2 + 6m + 9) - (2m^2 + 5m + 3) = 0$

$-m^2 + m + 6 = 0 \Rightarrow m^2 - m - 6 = 0$

$(m - 3)(m + 2) = 0 \Rightarrow m = 3$ or $m = -2$.

Answer: m = 3 or m = -2

Q8. Solution & Steps

Hint: Notice that sum of coefficients = (a - b) + (b - c) + (c - a) = 0,

Using D = 0

(2a - b – c) = 0

=> 2a = b + c. (Hence Proved)

Answer: 2a = b + c (Proved)

Q9. Solution & Steps

Hint: Let the natural number be x (x > 0). Given: x + 12 = 160 / x.

Time against headwind = 24 / (10 - x).

Time with tailwind = 24 / (10 + x).

Acc. To Q. [24 / (10 - x)] - [24 / (10 + x)] = 1.

$x^2 + 48x - 100 = 0$.

Answer: Speed of the wind = 2 km/h

Q10. Solution & Steps

Hint: Let the positive number be x. Given: x - √x = 20.

Let $y = \sqrt{x}$ (where $y > 0$). Then $x = y^2$.

$y^2 - y = 20 \Rightarrow y^2 - y - 20 = 0$

$(y - 5)(y + 4) = 0$

Since $y > 0$, $y = 5$.

$x = y^2 = 5^2 = 25$.

Answer: The number is 25

https://youtu.be/9TBGtYX_AEY **(video solution of this test)**