Test answers - Quadratic equations and graphs

Year: Year 10 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. $(x-5)(x+2)=0$ (1), so $x=5$ **or** $x=-2$ (1) We need two numbers with product -10 and sum -3: -5 and 2. Set each bracket equal to zero.
b. $x^2+4x-21=0$ (1), $(x+7)(x-3)=0$, so $x=-7$ **or** $x=3$ (1) Rearrange so that one side is zero, then find two numbers with product -21 and sum 4: 7 and -3. Check: $9+12=21$.

Check (a): $25-15-10=0$ and $4+6-10=0$, so both roots work.

Answer to Question 2 (4 marks)

a. x-axis: $(x-5)(x+1)=0$, so $(5,0)$ **and** $(-1,0)$ (1); y-axis: $(0,-5)$ (1) The curve meets the x-axis where $y=0$. The y-intercept is the constant term, -5.
b. Line of symmetry $x=2$ (1). At $x=2$: $y=4-8-5=-9$, so $(2,-9)$ (1) The line of symmetry is halfway between the roots -1 and 5, at $x=2$. The turning point is the minimum point $(2,-9)$.

Check (b) by completing the square: $y=(x-2)^2-9$, giving the same turning point.

Answer to Question 3 (4 marks)

a. $60-20=$ **40 m** (1) Substitute $t=2$: $30\times 2=60$ and $5\times 2^2=20$. The rocket is 40 m high.
b. $30t-5t^2=0$, $5t(6-t)=0$ (1), so $t=6$ (1) Set the height equal to zero and factorise. $t=0$ is the launch, so the rocket lands after 6 seconds.
c. At $t=3$: $90-45=$ **45 m** (1) The maximum is halfway between the times when $h=0$, at $t=3$. The maximum height is 45 m.

Answer to Question 4 (4 marks)

a. $x(x+6)=55$ so $x^2+6x-55=0$ (1) The area of a rectangle is width times length; expand the bracket and subtract 55.
b. $(x+11)(x-5)=0$ (1), so $x=5$ (reject -11) (1) We need product -55 and sum 6: 11 and -5. A width cannot be negative, so $x=5$.
c. Width 5, length 11, perimeter $=2\times 16=$ **32 cm** (1) The rectangle is 5 cm by 11 cm, so the perimeter is 32 cm.

Answer to Question 5 (4 marks)

a. $x = \dfrac{2 \pm \sqrt{4+48}}{6} = \dfrac{2 \pm \sqrt{52}}{6}$ (1), so $x = 1.54$ **or** $x = -0.87$ (1) Here $a = 3$, $b = -2$ and $c = -4$, so $b^2 - 4ac = 4 + 48 = 52$. The solutions are 1.54 and -0.87.

b. $(x-4)^2 - 13$ (1) Halve -8 to get -4, then subtract 16: $3 - 16 = -13$.

c. The minimum value is **−13** (1) A square is never negative, so the smallest value happens when $x - 4 = 0$. The minimum value is -13.

Check (a): $3(1.54)^2 - 2(1.54) - 4 \approx 0$. The exact answers are $\frac{1 \pm \sqrt{13}}{3}$.