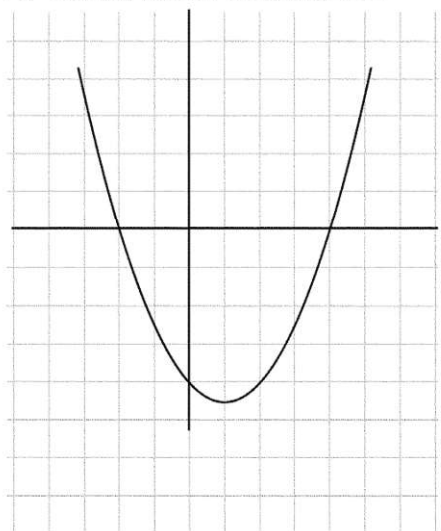


SAMPLE QUESTIONS AND ANSWERS

2007 Paper 1: Question 6 – Higher Junior Cert

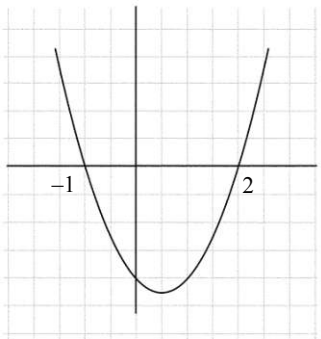
6. (a) ✍ Given that $f: x \rightarrow 3x+1$ and $g: x \rightarrow 1+x^2$, solve for $x: f(x) = g(x), x \in \mathbf{N}$.
- (b) (i) ✍ Given that $x = 2a+1$ and $y = 2ax - 4a^2$, express y in terms of a .
- (ii) ✍ Hence, or otherwise, find the value of x for which $y = 4$.
- (c) The diagram shows part of the graph of the function $f: x \rightarrow x^2 + bx + c$, where $x \in \mathbf{R}$ and $b, c \in \mathbf{Z}$.



The graph intersects the x -axis at $(-1, 0)$ and $(2, 0)$.

- (i) ✍ Calculate the value of b and the value of c .
- (ii) ✍ $(k, -k+14)$ is a point on the graph, where $k \in \mathbf{Z}$. Find the values of k .

2007 Paper 1: Solution 6 – Higher Junior Cert

- (a) $f(x) = 3x+1, g(x) = 1+x^2$ To solve $f(x) = g(x)$
 $\Rightarrow 1+x^2 = 3x+1 \Rightarrow x^2 - 3x = 0 \Rightarrow x(x-3) = 0$
 $\Rightarrow x = 0, x = 3$
 Careful here. $x^2 - 3x = 0$ is a quadratic equation 2 solutions (10 marks)
- (b) (i) $x = 2a+1, y = 2ax - 4a^2 \Rightarrow y = 2a(2a+1) - 4a^2$ (replace x by $2a+1$)
 $\Rightarrow y = 4a^2 + 2a - 4a^2 \Rightarrow y = 2a$ (10 marks)
- (ii) If $y = 4 \Rightarrow 2a = 4$ and $x = 2a+1 \Rightarrow x = 4+1 = 5$ (10 marks)
- (c) (i)  $f(x) = x^2 + bx + c$
 From the graph $x = -1$ and $x = 2$ are roots
 $(x+1)$ and $(x-2)$ are factors
 $f(x) = (x+1)(x-2) = x^2 - 2x + x - 2$
 $= x^2 - x - 2 = x^2 + bx + c$
 $b = -1, c = -2$
 $\therefore f(x) = x^2 - x - 2$ (10 marks)
- (ii) If $(k, -k+14)$ is on the graph $f(k) = -k+14$
 $k^2 - k - 2 = -k + 14 \Rightarrow k^2 - 16 = 0$
 $(k-4)(k+4) = 0 \Rightarrow k = 4, k = -4$ (10 marks)

Comment: Nice question. Short and concise. No tricky bits.

THE EXPERT

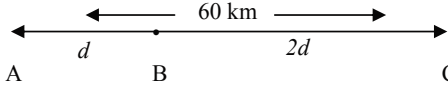


John Brennan has more than 30 years of experience teaching maths and is the author of three books in the *Maths Solutions* series. He spent most of his career at St Benildus College, Dublin and is now a senior teacher at Ballinteer Institute, Dublin. He is editor of www.juniorcert.ie and www.leavingcert.ie.

2007 Paper 1: Question 4 – Higher Junior Cert

4. (a) ✍ When $x = \frac{1}{3}$, find the value of $\frac{3}{x+1} + \frac{4}{x+5}$.
- (b) (i) ✍ Factorise $6c + 12bd - 8d - 9bc$.
- (ii) ✍ Simplify $(7x-2)(7x+2) - (5y-2)(5y+2)$ and fully factorise the simplified expression.
- (c) The distance from town A to town B is half the distance from town B to town C. The total journey from town A to town C, through town B, is 60 km. A car travels at x km/h from town A to town B. It increases its speed by 20 km/h on the journey from town B to town C. The total time for the journey is 50 minutes.
 ✍ Find the value of x .

2007 Paper 1: Solution 4 – Higher Junior Cert

- (a) Given $x = \frac{1}{3}$ find the value of $\frac{3}{x+1} + \frac{4}{x+5}$
 Replace x by $\frac{1}{3}$: $\frac{3}{(1/3)+1} + \frac{4}{(1/3)+5}$. Evaluate each fraction separately
 $\frac{3}{(1/3)+1}$: use your calculator as follows $3 \div (1ab/c3+1) = 2\frac{1}{4}$
 $\frac{4}{(1/3)+5}$: use your calculator as follows $4 \div (1ab/c3+5) = \frac{3}{4}$
 $\therefore \frac{3}{x+1} + \frac{4}{x+5} = 2\frac{1}{4} + \frac{3}{4} = 3$ (10 marks)
- (b) (i) $6c + 12bd - 8d - 9bc$. Rearrange the terms
 $6c - 8d - 9bc + 12bd$ (a bit tricky!)
 $2(3c - 4d) - 3b(3c - 4d) \Rightarrow (3c - 4d)(2 - 3b)$ (10 marks)
 OR $6c - 9bc - 8d + 12bd = 3c(2 - 3b) - 4d(2 - 3b) = (2 - 3b)(3c - 4d)$
- (ii) $(7x-2)(7x+2) - (5y-2)(5y+2)$
 $= 49x^2 + 14x - 14x - 4 - (25y^2 + 10y - 10y - 4)$
 $= 49x^2 - 25y^2 = (7x-5y)(7x+5y)$ (10 marks)
- (c) 
 $3d = 60 \text{ km}, d = 20 \text{ km}, 2d = 40 \text{ km}$
 Time = distance/speed
 Time from A to B is $\frac{20}{x}$, time from B to C is $\frac{40}{x+20}$
 $\frac{20}{x} + \frac{40}{x+20} = \frac{50}{60} = \frac{5}{6}$ hours multiply everything by $6(x)(x+20)$
 $20(x+20)6 + 40(x)(6) = 5(x)(x+20)$
 $120x + 2400 + 240x = 5x^2 + 100x \Rightarrow 5x^2 - 260x - 2400 = 0$ divide by 5 to get
 $\Rightarrow x^2 - 52x + 480 = 0$
 $(x-60)(x+8) = 0 \Rightarrow x = 60 \text{ km/hour}$ (20 marks)

Comment: Part (c) was quite difficult and a bit different from normal.