Proof Past Paper Answers GCSE Edexcel – Non-Calculator

1.

tion	Answer	Mark	Mark scheme	Additional guidance
	proof	C1	for writing an expression for an odd number, eg $2n + 1$ or $2n - 1$ (assuming n is any integer) **or** states n is even and eg $(n + 1)$ or $(n + 3)$ as odd numbers	
		C1	for a correct expression of the form $(2n + 1)^2 - (2n - 1)^2$ expanded eg $4n^2 + 12n + 9 - (4n^2 + 4n + 1)$ or $4n^2 + 4n + 1 - (4n^2 - 4n + 1)$ **or** $(2n + 1 + 2n - 1)(2n + 1 - (2n - 1))$ **or** when n is even and eg $(n^2 + 6n + 9) - (n^2 + 2n + 1)$ $(=4n + 8)$	Expansion of $(2n - 1)^2 - (2n + 1)^2$ oe is acceptable
		C1	for a correct simplified expression as a multiple of 8 eg $8n + 8$ or $8n$ **or** when n is even **and** eg $4n + 8$ **and** full explanation as to why $4(n+2)$ is always a multiple of 8	

2.

stion	Answer	Mark	Mark scheme	Additional guidance
	Statement supported by algebra	B1	writing a general expression for an odd number eg $2n+1$	Could be $2n - 1$, $2n + 3$, etc
		M1	(dep) for expanding ("odd number")^2 with at least 3 out of 4 correct terms	Note that $4n^2 + 4n + 2$ or $2n^2 + 4n + 1$ in expansion of $(2n + 1)^2$ is to be regarded as 3 correct terms
		A1	for correct simplified expansion, eg $4n^2 + 4n + 1$	
		C1	(dep A1) for a concluding statement eg $4(n^2 + n) + 1$ (is one more than a multiple of 4)	

3.

estion	Working	Answer	Mark	Notes
(a)		2	M1	for start to express the common ratio algebraically, eg $1/(\sqrt{x} - 1)$ or $(\sqrt{x} + 1)/1$ or $\sqrt{x} + 1 = k \times 1$ or $1 = k \times (\sqrt{x} - 1)$
			M1	for setting up an appropriate equation in x, eg $1/(\sqrt{x} - 1) = (\sqrt{x} + 1)/1$
			C1	for convincing argument to show $x = 2$
(b)		Shown	M1	for expressing the relationship between the common ratio, one of the first three terms of the sequence and the fifth term, eg 5th term = 3rd term × (common ratio)²
			C1	for a complete explanation to include eg, $(\sqrt{2} + 1)(\sqrt{2} + 1)^2 = 7 + 5\sqrt{2}$

4.

Proof (supported)	M1	starts process to find point of intersection by substituting, eg $(10 + 2y)^2 + y^2$ (= 20)
	M1	for expanding, eg $4y^2 + 20y + 20y + 100$ (3 out of 4 terms correct)
	M1	(dep M2) for 3-term quadratic equation ready for solving, eg $5y^2 + 40y + 80 = 0$
	M1	(dep on previous M1) for method to solve an equation of the form $ay^2 + by + c = 0$, eg by factorising or correct substitution into quadratic formula
	C1	fully correct method leading to $y = -4$ or $x = 2$ or $(y + 4)^2 = 0$ or $(x - 2)^2 = 0$ and statement, eg only one point of intersection so the line is a tangent to the circle

5.

	$x^3+6x^2+11x+6$	M1	for method to find the product of any two linear expressions (3 correct terms) e.g. $x^2+x+2x+2$ or $x^2+2x+3x+6$ or $x^2+x+3x+3$
		M1	for method of multiplying out remaining products, half of which are correct (ft their first product) e.g. $x^3+x^2+2x^2+3x^2+2x+3x+6x+6$
		A1	cao

6.

	$2(2n-3)$	C1	correct expansion of brackets to give at least 3 terms from $n^2-2n-2n+4$
	even	C1	arrives at n^2-2-n^2+4n-4 oe
		C1	reduces to $2(2n-3)$ or $4n - 6$
		C1	for conclusion e.g. $2(2n-3)$ always even, $4n - 6$ is always even since both are even numbers, they are multiples of 2.

7.

		Proof	B1	(indep) for stating $\cos 30 = \frac{\sqrt{3}}{2}$
			M1	for $PQ^2 = 10^2 + 10^2 - 2 \times 10 \times 10 \times \cos PBQ$ **or** $AC^2 = x^2 + x^2 - 2 \times x \times x \times \cos 30$ $(=x^2(2-\sqrt{3}))$ oe
			M1	for $\cos PBQ = \frac{10^2+10^2-PQ^2}{2\times10\times10}$ (implies previous M1)
	cos PBQ= $\frac{10^2+10^2-x^2(2-\sqrt{3})}{200}$ $= \frac{200-x^2(2-\sqrt{3})}{200}$		M1	for $\cos PBQ = \frac{10^2+10^2-(x^2+x^2-2\times x\times x\times\cos 30)}{2\times10\times10}$
			A1	conclusion of proof with all working seen

8.

proof	C1 C1 C1	starts proof eg $n(n+1)$ or $(n-1)\times n$ $n(n+1) + n+1$ or $(n-1)\times n + n$ for convincing proof including $(n+1)^2$ or n^2

9.

uestion	Working	Answer	Notes		
		proof (supported)	M1 M1 A1 C1	for any two consecutive integers expressed algebraically eg $n + 1$ and n (dep) for the difference between the squares of "two consecutive integers" expressed algebraically eg $(n + 1)^2 - n^2$ for correct expansion and simplification of difference of squares eg $2n + 1$ for showing statement is correct (with supportive evidence) eg $n + n + 1 = 2n + 1$ and $(n + 1)^2 - n^2 = 2n + 1$	for sight of $p^2 - q^2 = (p - q)(p + q)$ for deduction that $p - q = 1$ for linking these two statements eg substitution of 1 for $p - q$ for fully stated proof and deduction eg $p^2 - q^2 = 1 \times (p + q) = p + q$

10.

$(3x - 1)(4x^2 + 20x - 3x - 15)$ $(x + 5)(12x^2 - 4x - 9x + 3)$ $(4x - 3)(3x^2 - x + 15x - 5)$	Fully correct algebra to show given result	M1 M1 A1	for method to find the product of any two linear expressions; eg. 3 correct terms or 4 terms ignoring signs (dep) for method of 6 products, 4 of which are correct (ft their first product) for fully accurate working to give the required result

11.

Working	Answer	Notes
	Proof	B1 state the difference of two squares in algebraic notation eg $p^2 - q^2$ M1 for writing down expressions for two different terms from the sequence eg $6n + 1$ and $6m + 1$ M1 for expanding one squared bracket to obtain 4 terms with all 4 correct without considering signs or for 3 terms out of 4 correct with correct signs A1 for $36(m^2 - n^2) + 12(m - n)$ oe M1 (dep M2) for factorising their expression by 12 C1 for fully correct working with statement justifying $(m - n)(3(m + n) + 1)$ is even eg considering odd and even combinations

12.

stion	Working	Answer	Notes	
	$(4n^2+2n+2n+1)$ $-(2n+1)=$ $4n^2+4n+1-2n-1$ $= 4n^2 + 2n$ $= 2n(2n + 1)$	proof (supported)	M1 P1 C1	for 3 out of 4 terms correct in the expansion of $(2n + 1)^2$ **or** $(2n+1)\{(2n+1)-1\}$ for $4n^2 + 2n$ or equivalent expression in factorised form for convincing statement using $2n(2n + 1)$ or $2(2n^2 + n)$ or $4n^2 + 2n$ to prove the result

13.

	$\frac{23}{90}$	M1	For a fully complete method as far as finding two correct decimals that, when subtracted, give a terminating decimal (or integer) and showing intention to subtract eg $x = 0.2\dot{5}$ so $10x = 2.5\dot{5}$ then $9x = 2.3$ leading to…
		A1	correct working to conclusion

14.

$\frac{2x+1}{3x+5}$	M1	for $(3x \pm 5)(2x \pm 1)$ or $(2x + 1)(2x - 1)$
	M1	$\frac{1}{(3x \pm 5)(2x \pm 1)} \times (2x+1)(2x-1)$
	A1	