Proof

Mark Scheme

1. (a) $5n$ 1

B1 cao

(b) (i) $5n + 5(n \pm 1)$

$10n \pm 5$

$5(2n \pm 1)$

Both 5 and $2n \pm 1$ are odd 2

M1 for $5n + 5(n \pm 1)$ or $10n \pm 5$ or for $5(2n \pm 1)$

A1 for stating both 5 and $2n \pm 1$ are odd and odd × odd = odd oe

(ii) $5n \times 5(n \pm 1)$

$25n(n \pm 1)$

25 is odd, one of n or $n \pm 1$ is odd so odd × even × odd = even 3

M1 for $5n \times 5(n \pm 1)$

A1 for realises that one of n and $n \pm 1$ will be even or considers $5n$ or $5(n \pm 1)$ for both odd and even

A1 for establishing correct result oe

(SC if M0, MO awarded in part (b) B1 for using in b(i) or (ii) a numerical argument with more than 2 examples)

(SC for 5n and 5n±1 used B1 in (i) and B1 in (ii) for fully reasoned argument)

[6]

2. Printed result proved algebraically 4

$2n$ and $2n + 2$, where n is an integer

$(2n)^2 + (2n + 2)^2 = 4n^2 + 4n^2 + 8n + 4 = 8(n^2 + n) + 4$

$8(n^2 + n)$ is always a multiple of 8 so

$8(n^2 + n) + 4$ is never a multiple of 8. oe

B1 for either 2n or 2n + 2

M1 for correct expansion

A1 for correct simplified algebraic expression with some factorisation

A1 convincing conclusion to the mathematical argument

[4]

3. Either $(n^2 + 2n + 1) - (n^2 - 2n + 1) = 4n$
or $(n + 1 + n - 1)(n + 1 - (n - 1)) = 2n \times 2 = 4n$ 3

B1 + B1 for $(n^2 + 2n + 1) - (n^2 - 2n + 1)$ must have brackets for the 2nd B1
B1 for 4n
Or
B1 for either $(n + 1 + n - 1)$ or $(n + 1 - (n - 1))$
B1 for $(n + 1 + n - 1)(n + 1 - (n - 1))$
B1 for 4n
SC: $n^2 + 2n + 1 - n^2 - 2n + 1 = 4n$ is 2/3

[3]

4. 7 which is not even 2

$2^2 + 3 =$

B2
(B1 for correctly evaluating $n^2 + 3$ with a prime number value for n.)

[2]

5. $(2m + 1)^2 = 4m^2 + 4m + 1$
$(2n + 1)^2 = 4n^2 + 4n + 1$
Sum $= 4m^2 + 4n^2 + 4m + 4n + 2$
$= 4(m^2 + n^2 + m + n) + 2$ 3

B1 for $(2m + 1)^2$
B1 for sum of correct expansion of 2 correct expressions for different odd squares
B1 fully correct answer including the factor 4, and a clear remainder of 2
SC B1 for $(n + 2)^2 + n^2$ oe

[3]