Friday 26th June:
Algebraic Proof part 2
Grade 8-9

1) $(n+5)(n+8)+7n$

$n^2+8n+5n+40+7n$

$n^2+20n+40$

2) $(n+6)(n+6)+3n+6$

$n^2+6n+6n+36+3n+6$

$n^2+15n+42$

3) $(n+2)(n+2)+4n+7$

$n^2+2n+2n+4+4n+7$

$n^2+8n+11$

Silver

1) Prove $6n+7+4n+8$ is a multiple of 5.

$10n+15$

$5(2n+3)$ → multiple of 5.

2) prove that $7n+4+5n+5$ is a multiple of 3.

$12n+9$

$3(4n+3)$ → multiple of 3.

Gold

1) prove the sum of 3 consecutive numbers is a multiple of 3.

$a \quad a+1 \quad a+2$

$= 3a+3$
$= 3(a+1)$

1) prove the sum of an odd and ~~and~~ an odd number is an even number.

~~a~~ ~~a+4~~ ~~a+2~~

odd = $2n-1$
even = $2n$
any = n

$2n-1+2n-3$
$= 4n-4$
$= 2(n-2)$
→ even.

① Prove that $(3n+1)^2-(3n-1)^2$ is a multiple of 6 for all positive interger values of n.

$(3n+1)(3n+1) - (3n-1)(3n-1)$

$9n^2+6n+1 - 9n^2 - 6n+1$

$9n^2+6n+1$
$-\quad -\quad -$
$9n^2-6n+1$

$=12n$
$=6(2n)$
→ multiple of 6

② Prove that $(4n+1)^2 - (4n-1)^2$ is a multiple of 8 for all positive interger values.

$(4n+1)(4n+1) - (4n-1)(4n-1)$

$16n^2+4n+4n+1 \qquad 16n^2-4n-4n+1$

$16n^2+8n+1 \qquad 16n^2-8n+1$

$16n^2+8n+1$
$-\quad -\quad -$
$16n^2-8n+1$

$=16n$
$=8(2n)$
→ multiple of 8.

③ $(5n+1)^2 - (5n-1)^2$ multiple of 5

$(5n+1)(5n+1) \qquad (5n-1)(5n-1) \qquad = 20n$

$25n^2+10n+1 \qquad 25n^2-10n+1 \qquad = 5(4n)$

→ multiple of 5.

④ $(2n+1)^2 - (2n-1)^2$ multiple of 8

$(2n+1)(2n+1) - (2n-1)(2n-1) = 8n$

$= 8(n)$

$4n^2 + 4n + 1 \qquad 4n^2 - 4n + 1$

multiple of 8.

⑤ $(5n+1)^2 - (5n-1)^2$ multiple of 4

$(5n+1)(5n+1) \qquad (5n-1)(5n-1)$

$25n^2 + 10n + 1 \qquad 25n^2 - 10n + 1 = 20n$

multiple of 4

$= 4(5n)$

⑥ $(2n+1)^2 - (2n-1)^2 - 10$ not a multiple of 8.

$(2n+1)(2n+1) \qquad (2n-1)(2n-1)$

$4n^2 + 4n + 2 \qquad 4n^2 - 4n + 1 \quad -10 = 8n - 16$

8 does not go into it.

If $(2n+1)$ is always odd for all positive interger values of n. Prove algebraically that the sum of the ~~squares~~ ~~any two square~~ squares of any two consecutive odd numbers cannot be a multiple of 4.

even = $2n$

odd = $2n-1$

any = n

$(2n-1)^2 + (2n-3)^2$

$(2n-1)(2n-1) + (2n-3)(2n-3)$

$4n^2 - 2n - 2n + 1 \qquad 4n^2 - 6n - 6n + 9$

$4n^2 - 4n + 1 + 4n^2 - 12n + 9 = \cancel{8n^2} - 16 + 10$

4 cannot go in