Continuing to Explore Four Consecutive Numbers.

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Consecutive definition:

$a = a$

$b = a+1$

$c = a+2$

$d = a+3$

1. Definition of odd and even:

Let $\mathbb{Z}$ be any integer.

$2\mathbb{Z}$ is even.

$2\mathbb{Z}+1$ is odd.

$$\begin{aligned} & bd-ac \\ &= (a+1)(a+3)-a(a+2) \\ &= 2a+3 \\ &= 2a+2+1 \\ &= 2(a+1)+1 \\ &= 2\mathbb{Z}+1 \end{aligned}$$

$\therefore (bd-ac)$ is odd. It is not even.

2.
$$\begin{aligned} & bc-ad \\ &= (a+1)(a+2)-a(a+3) \\ &= a^2+3a+2-a^2-3a \\ &= 2 \end{aligned}$$

$(bc-ad)$ is always equal to 2.

3.
$$\begin{aligned} & a+b+c+d \\ &= a+a+1+a+2+a+3 \\ &= 4a+6 \\ &= 2(2a+3) \end{aligned}$$

$(a+b+c+d)$ has an odd factor of $(2a+3)$.

$(2a+3)$ is odd because:

$$\begin{aligned} & 2a+3 \\ &= 2(a+1)+1 \\ &= 2\mathbb{Z}+1 \end{aligned}$$

$\therefore$ The sum $(a+b+c+d)$ must have an odd factor.

4. $a+b+c+d$
$= a+a+1+a+2+a+3$
$= 4a+6$
$= 2(a+3)$
$(a+b+c+d)$ can be factorised to 2 and an odd number. An odd number cannot have a factor of 2. To have a factor of 4 for $(a+b+c+d)$, it needs to have at least two factors of 2.
∴ The sum $(a+b+c+d)$ cannot be a multiple of 4.

5. $a+b+c+d$
$= 2(a+3)$
In order for $(a+b+c+d)$ to be divisible by 3, $(a+3)$ must be divisible by 3. 3 is already a multiple of 3.
∴ The smallest of the 4 consecutive numbers must be 0 or any multiple of 3.