Grass consumption by Oxen

<u>Problem:</u> If 6 acres of grass, together with what grows on the 6 acres during the time of grazing, keep 16 oxen for 12 weeks, and 9 acres keep 26 oxen 9 weeks, how many oxen will 15 acres keep 10 weeks, the grass growing uniformly all the time?

<u>Solution:</u>

Let, a = the amount of grass per acre

b = the amount of new grass per acre each week

c = the amount of grass eaten by each ox

So, we get

$6a + 6 \cdot 12 \cdot b = 16 \cdot 12 \cdot c \Longrightarrow 6a + 72b = 192c$ ………….(equation 1)

$9a + 9 \cdot 9 \cdot b = 26 \cdot 9 \cdot c \Longrightarrow 9a + 81b = 234c$…………….(equation 2)

$15a + 15 \cdot 10 \cdot b = x \cdot 10 \cdot c \Longrightarrow 15a + 150b = 10cx$……..(equation 3)

Solve equation 3 for x, we get $x = \dfrac{15a+150b}{10c}$ …………………………(equation 4)

Solve equation 2 for k, we get $k = \dfrac{a+9b}{26}$, and

Solve equation 1 for k, we get $k = \dfrac{a+12b}{32}$

So, we can write $\dfrac{a+9b}{26} = \dfrac{a+12b}{32}$

$$32a + 288b = 26a + 312b$$

$$6a = 24b$$

$$a = 4b$$

Substitute a in equation 1, we get $6 \cdot 4b + 72b = 192c$

$$24b + 72b = 192c$$

$$96b = 192c$$

$$b = 2c$$

Therefore, $a = 8c$

Now, solving (equation 4) for x, we get $x = \frac{15 \cdot 8c + 150 \cdot 2c}{10c} = \frac{420c}{10c} = 42$

So, 15 acres will keep 42 oxen for 10 weeks.