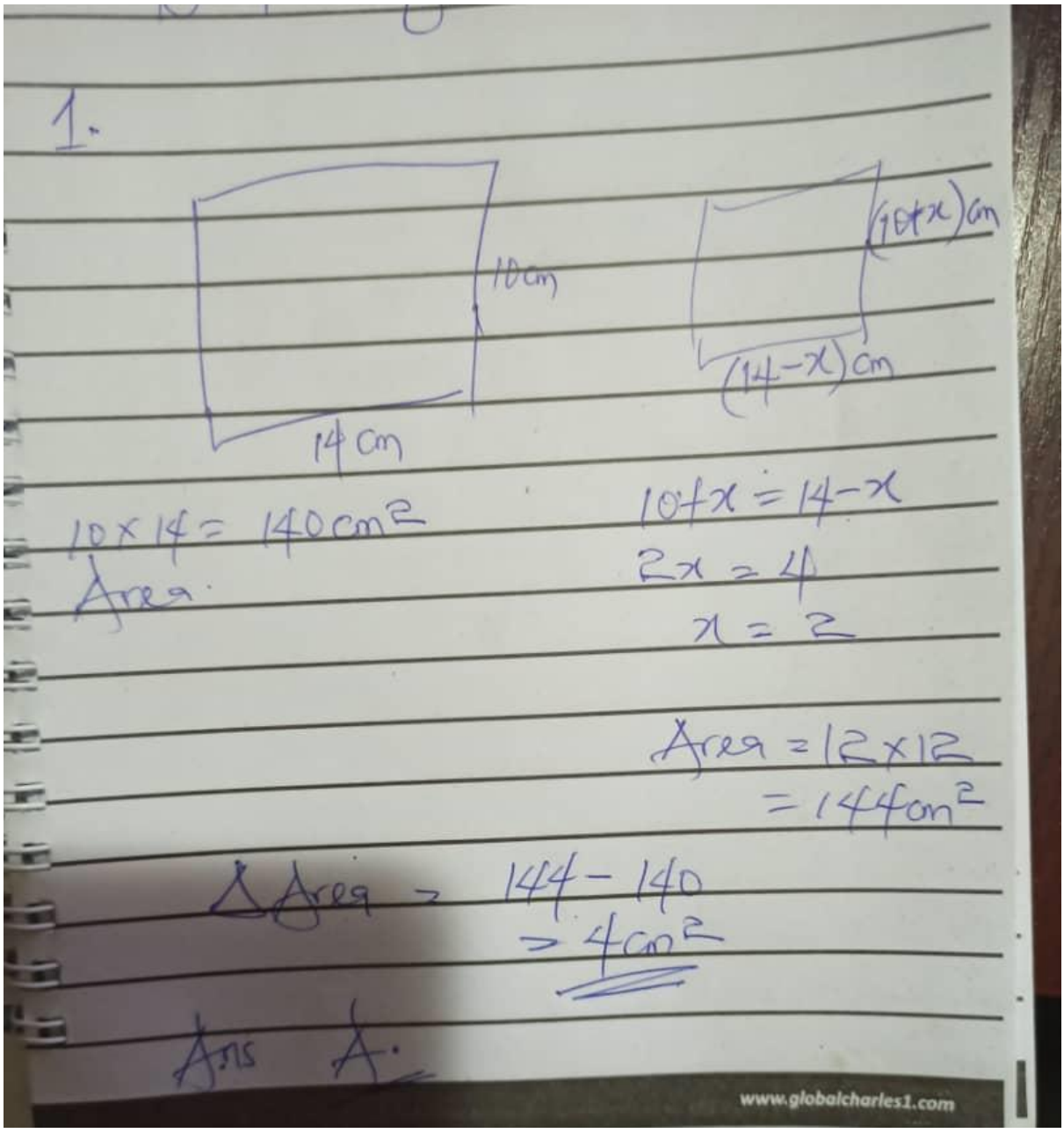
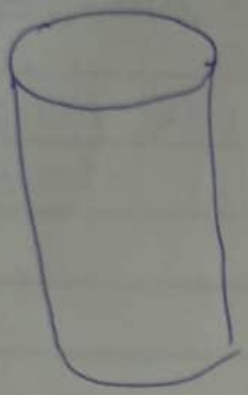
DELOITTE NUMERICAL SOLUTION COMPILATION

Part A



2.



Parameters

speed = 54 Km/hr
radius = 5meters
Time = 5minutes

Required = distance?

$\text{Speed} = \frac{\text{distance}}{\text{time}}$ $\Rightarrow 54 = \frac{d}{(5/60)}$ Km/hr hr

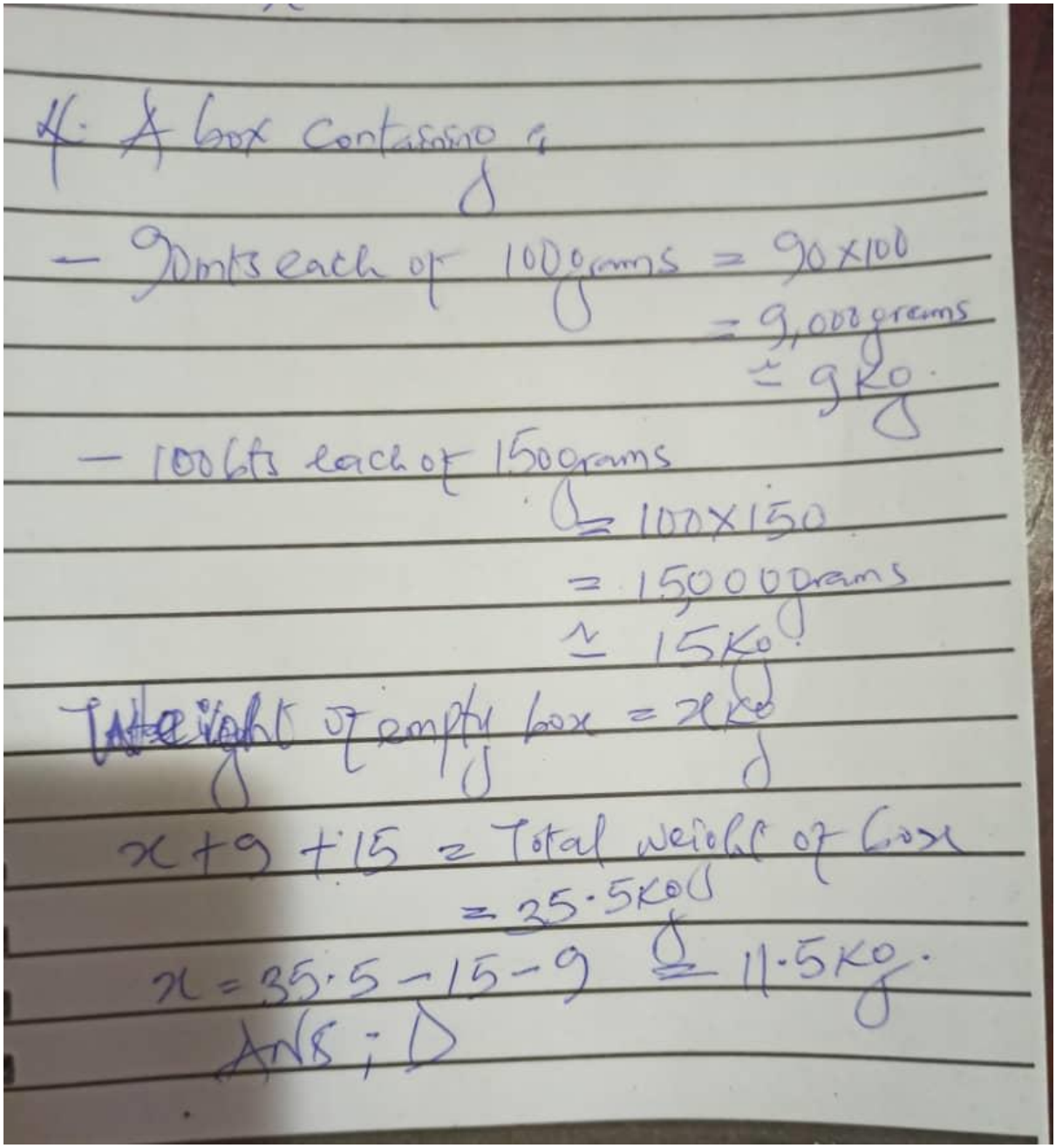
$d = 54 \times \frac{5}{60} = 4.5\text{Km}$

Ans : C

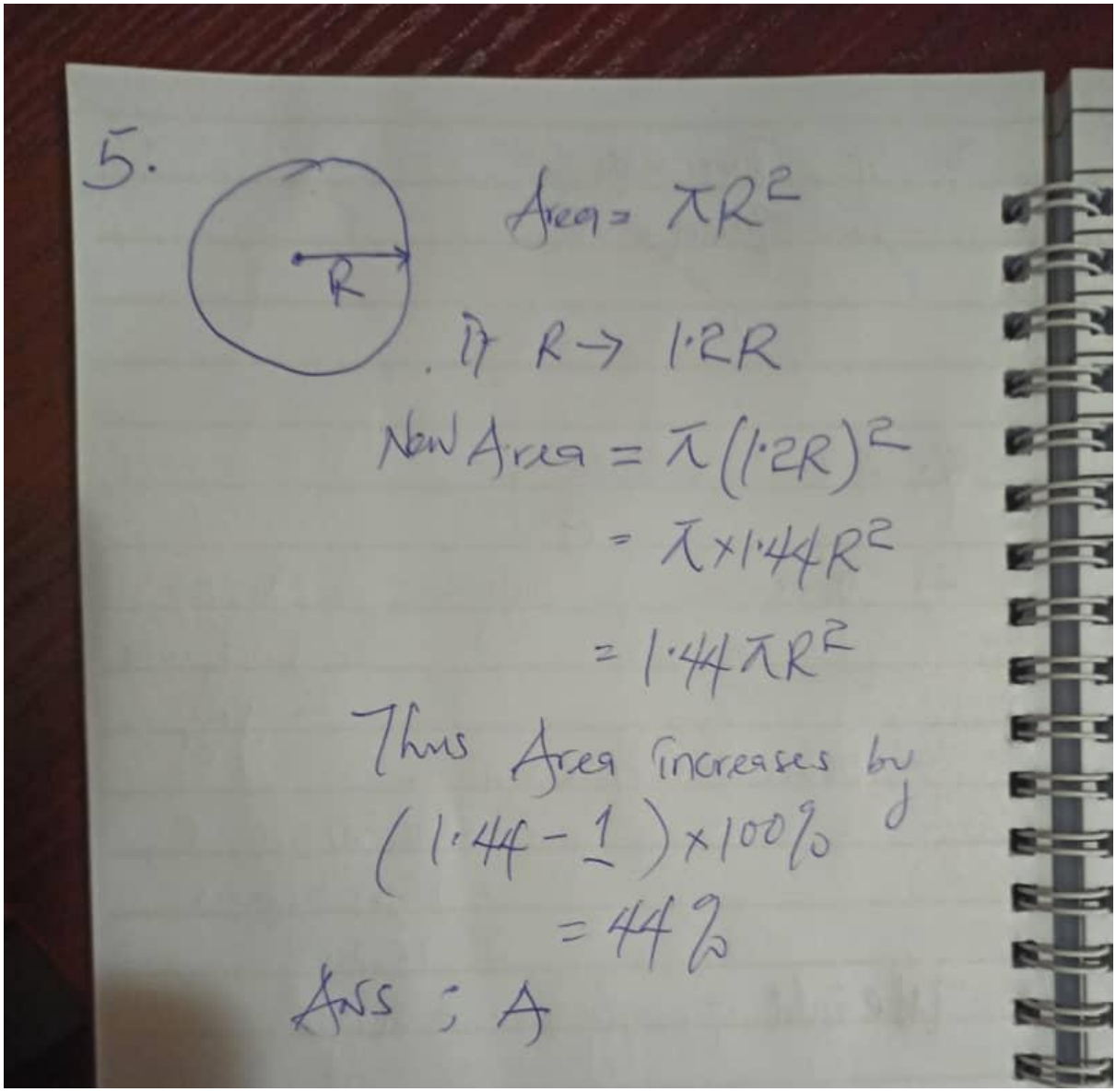
3. If 1cm = 40km
then 37.5cm = x

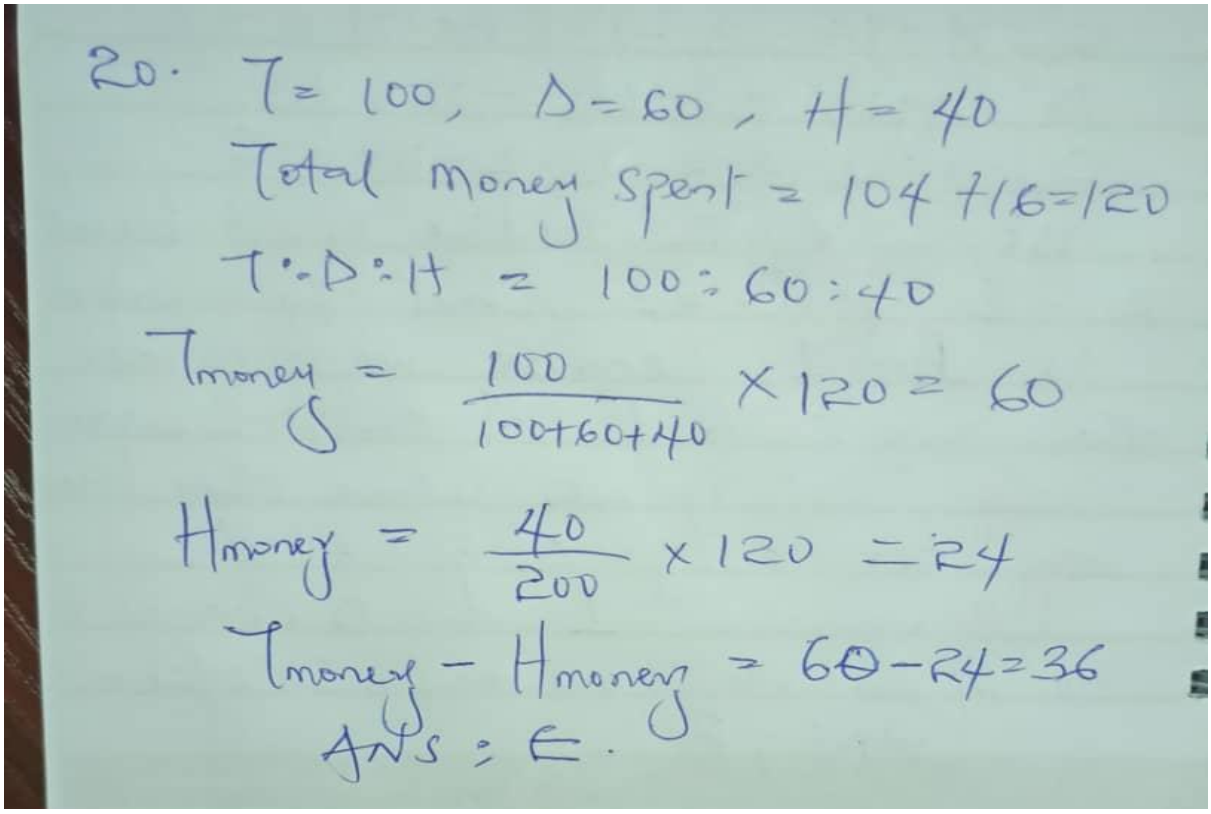
$x = \frac{37.5 \times 40}{1} = 1{,}500\text{Km}$

Ans; C

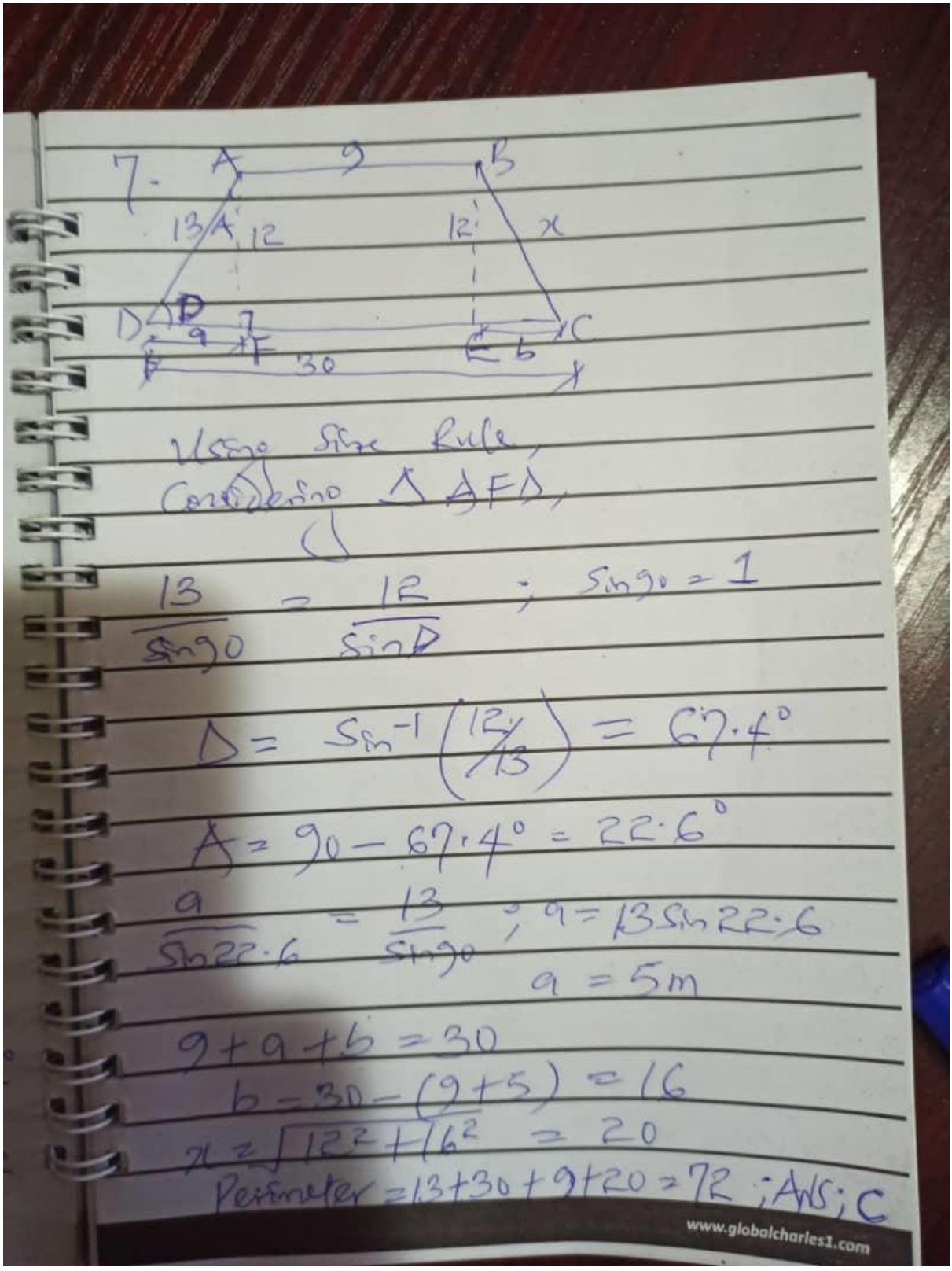


4. A box containing
- 9 units each of 1000grams = 9 × 100
= 9,000 grams
≈ 9kg.
- 100 bts each of 1500grams
= 100 × 150
= 15,000grams
≈ 15kg.
Weight of empty box = xkg
x + 9 + 15 = Total weight of box
= 35.5kg
x = 35.5 − 15 − 9 ≈ 11.5kg.
Ans: D


5.
R
Area = πR²
If R → 1·2R
New Area = π(1·2R)²
= π × 1·44R²
= 1·44πR²
This Area increases by
(1·44 − 1) × 100%
= 44%
Ans ; A


20. T = 100, D = 60, H = 40
Total money spent = 104 + 16 = 120
T : D : H = 100 : 60 : 40
Tmoney = 100/(100+60+40) × 120 = 60
Hmoney = 40/200 × 120 = 24
Tmoney − Hmoney = 60 − 24 = 36
Ans : C.

Same as no. 6



Using Sine Rule,
Considering $\triangle AFD$,

$$\frac{13}{\sin 90} = \frac{12}{\sin D} \quad ; \sin 90 = 1$$

$$D = \sin^{-1}\left(\frac{12}{13}\right) = 67.4^\circ$$

$$A = 90 - 67.4^\circ = 22.6^\circ$$

$$\frac{a}{\sin 22.6} = \frac{13}{\sin 90} \quad ; a = 13 \sin 22.6$$

$$a = 5m$$

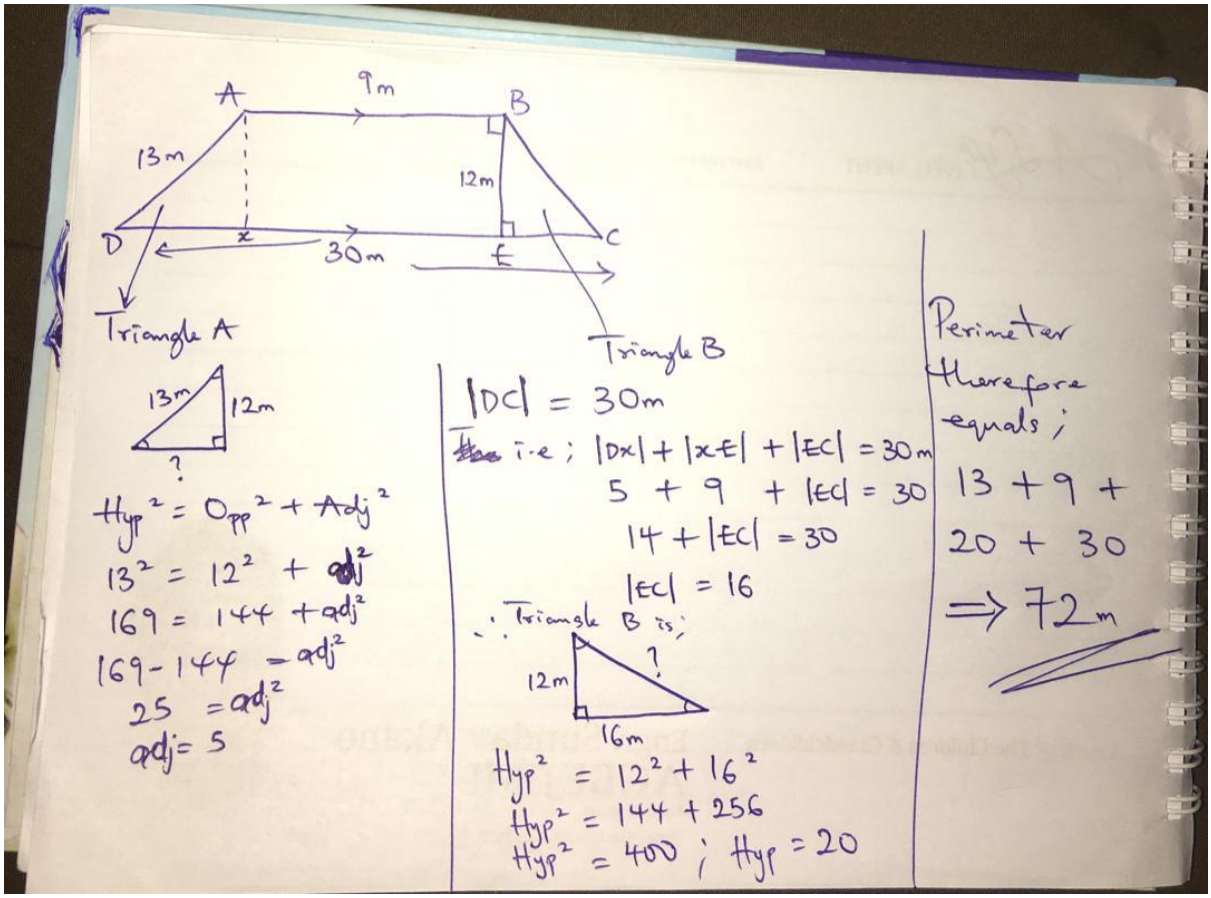
$$9 + a + b = 30$$

$$b = 30 - (9 + 5) = 16$$

$$x = \sqrt{12^2 + 16^2} = 20$$

Perimeter $= 13 + 30 + 9 + 20 = 72$; Ans; C

www.globalcharles1.com


A
9m
B
13m
12m
D
x
30m
E
C
Triangle A
13m
12m
?
Hyp² = Opp² + Adj²
13² = 12² + adj²
169 = 144 + adj²
169 - 144 = adj²
25 = adj²
adj = 5
Triangle B
|DC| = 30m
i.e; |Dx| + |xE| + |EC| = 30m
5 + 9 + |EC| = 30
14 + |EC| = 30
|EC| = 16
∴ Triangle B is;
12m
?
16m
Hyp² = 12² + 16²
Hyp² = 144 + 256
Hyp² = 400 ; Hyp = 20
Perimeter
Therefore
equals;
13 + 9 +
20 + 30
⇒ 72m

8. 25% of 28

$= 0.25 \times 28 = 7$

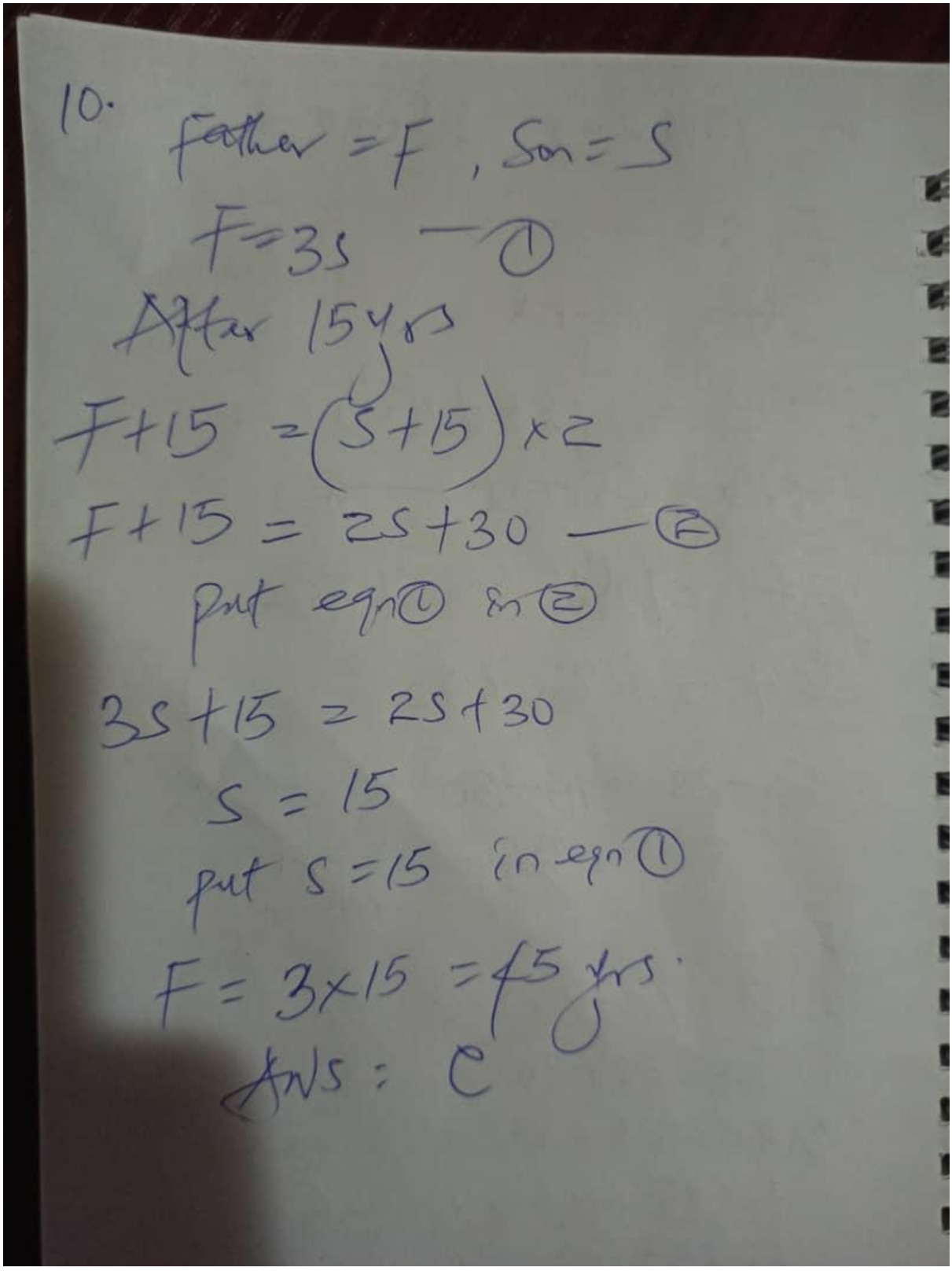
ANS; B

9. $3/p = 6$; $p = 3/6 = 1/2$

$3/q = 15$; $q = 3/15 = 1/5$

$p - q = \frac{1}{2} - \frac{1}{5} = \frac{5-2}{10} = \frac{3}{10}$

ANS ; C



10. Father = F, Son = S

$F = 3S$ — (1)

After 15 yrs

$F + 15 = (S + 15) \times 2$

$F + 15 = 2S + 30$ — (2)

put eqn (1) in (2)

$3S + 15 = 2S + 30$

$S = 15$

put $S = 15$ in eqn (1)

$F = 3 \times 15 = 45$ yrs.

Ans: C

Num 1.

11.

$$\left(\frac{1}{4}\right)^3 + \left(\frac{3}{4}\right)^3 + 3\left(\frac{1}{4}\right)\left(\frac{3}{4}\right)\left(\frac{1}{4} + \frac{3}{4}\right) = ?$$

$$\frac{1}{4^3} + \frac{27}{4^3} + \frac{9}{4^2}$$

$$= \frac{28}{4^3} + \frac{9}{4^2} = \frac{28 + 36}{4^3}$$

$$= \frac{64}{4^3} = \frac{64}{64} = 1$$

Ans : E

12. $A_1 : A_2 = 169 : 196$.

$$\pi R_1^2 : \pi R_2^2$$

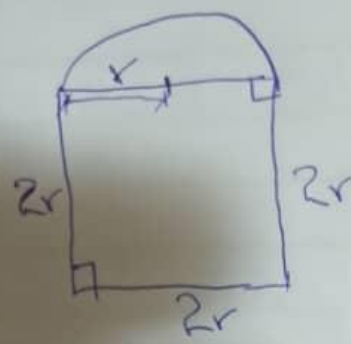
$$\pi R_1^2 = 169 \; ; \; \pi R_2^2 = 196$$

$$R_1 = \sqrt{169/\pi} \; ; \; R_2 = \sqrt{196/\pi}$$

$$= 13/\sqrt{\pi} \qquad = 14/\sqrt{\pi}$$

$R_1 : R_2 = 13 : 14$; Ans ; D

13.



Area of Semicircle
$= \frac{\pi r^2}{2}$

Area of Square
$= (2r)^2 = 4r^2$

$\frac{\pi r^2}{2} : 4r^2$

$\pi : 8$; Ans ; C

14. 40% of 30 = 12

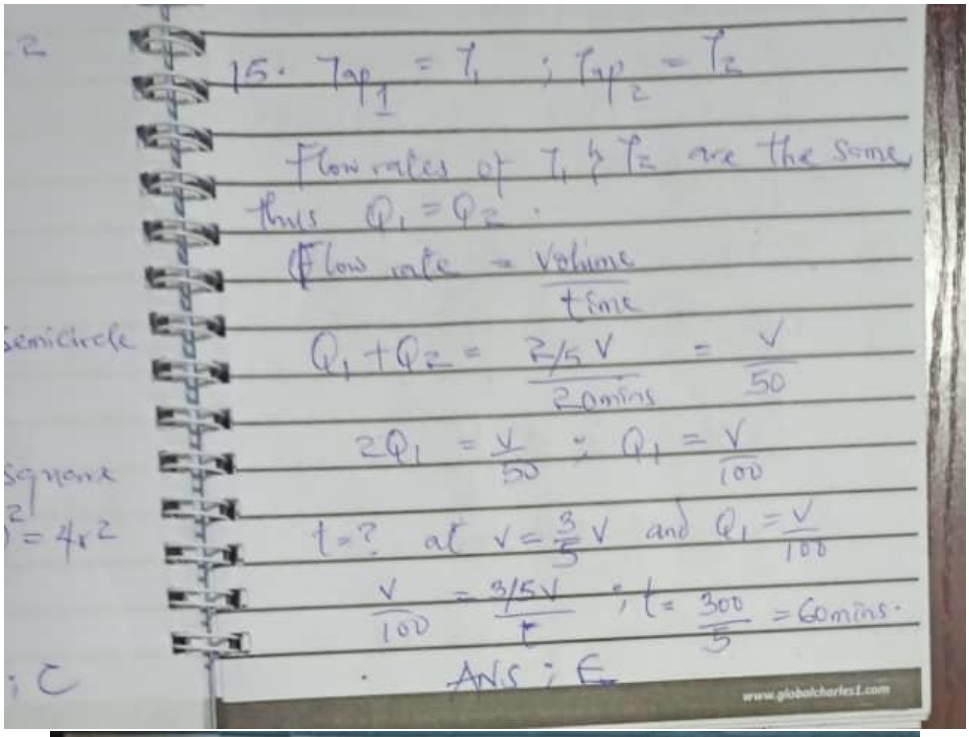
3/5 of 25 = 15

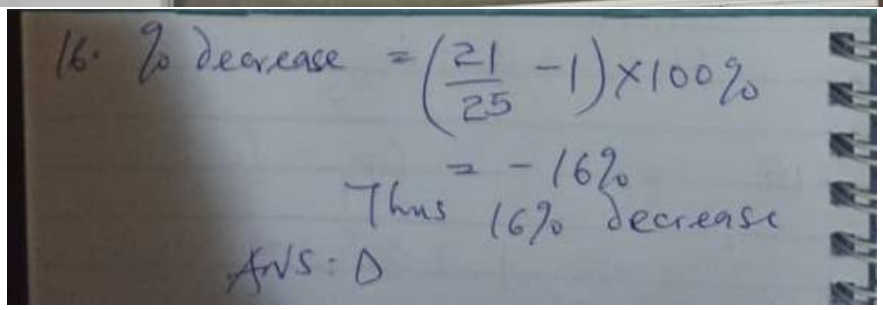
6.5% of 200 = 13

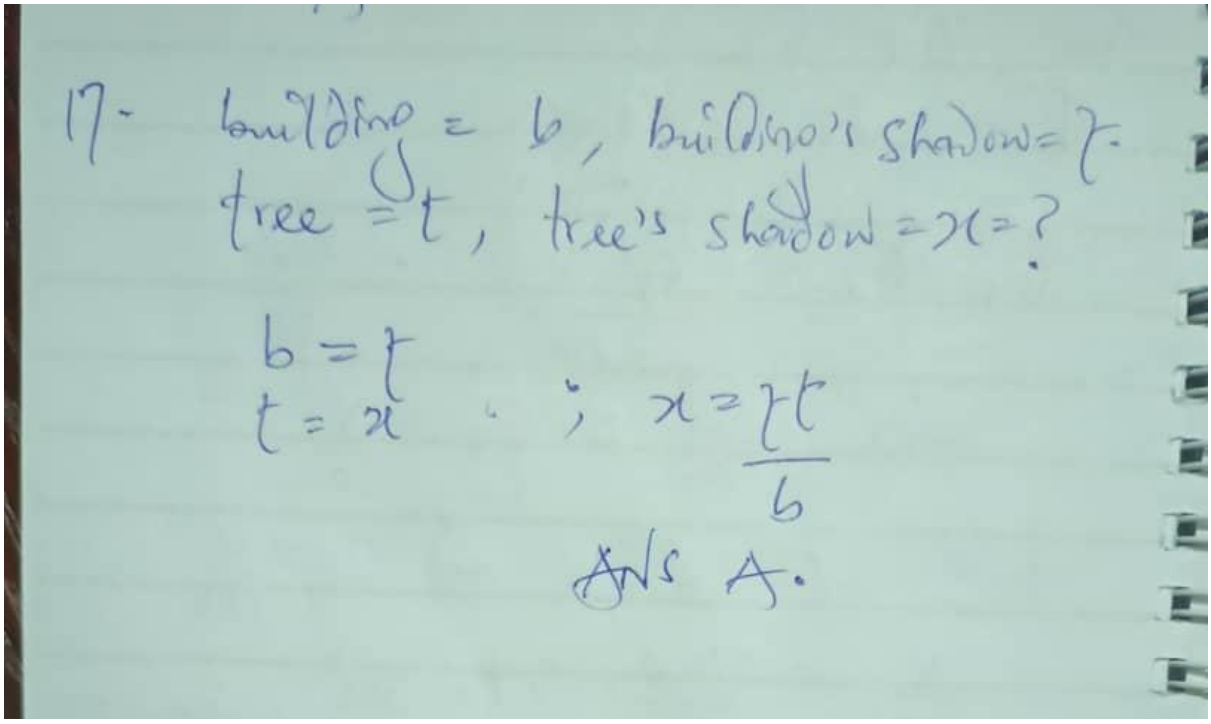
$5 + \sqrt{3}$ = 6.73

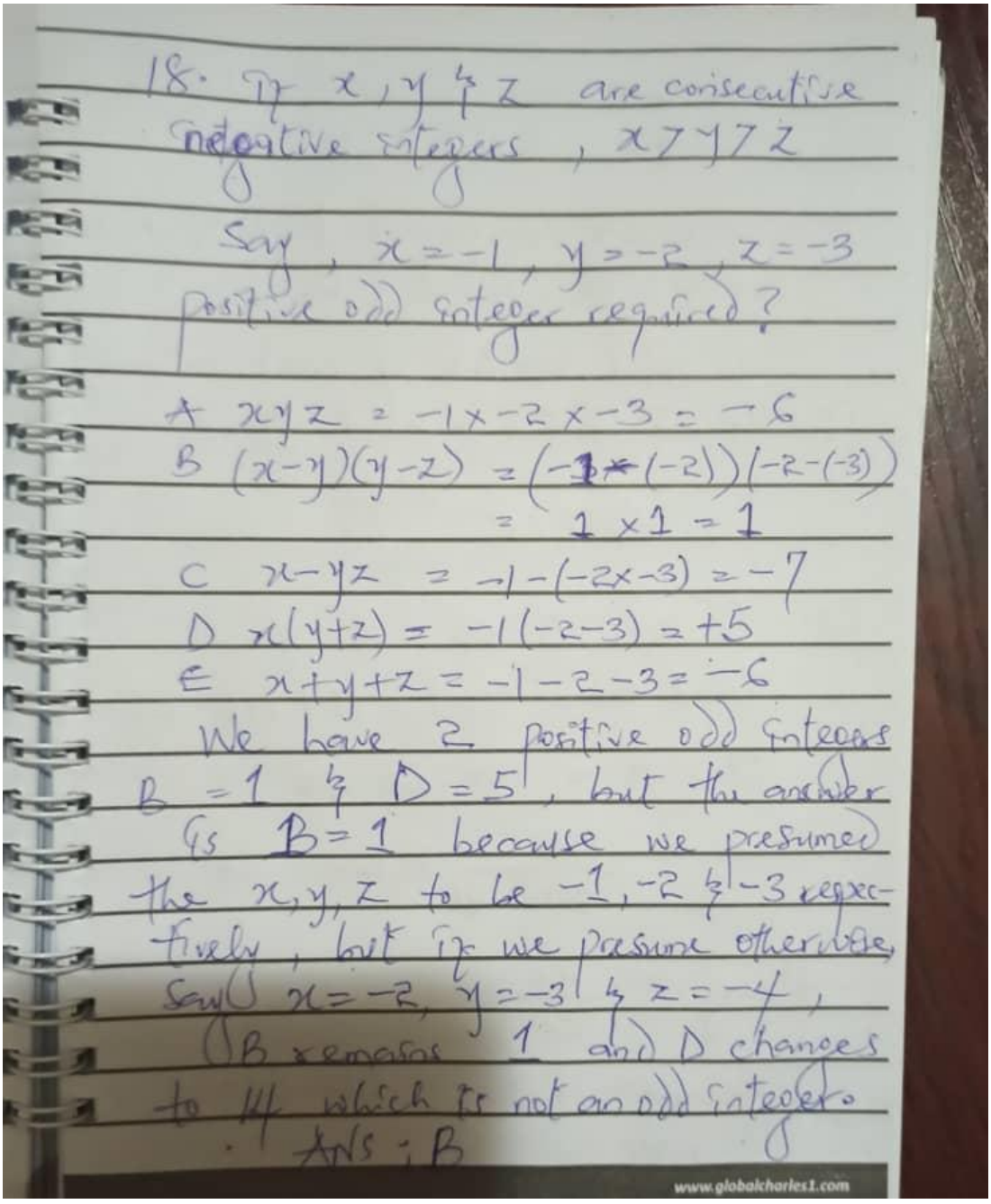
$(1/2)^{-4}$ = 16

Thus Ans ; E


15. Tap 1 = T1 ; Tap 2 = T2
Flow rates of T1 & T2 are the same
thus Q1 = Q2.
Flow rate = Volume / time
Q1 + Q2 = 2/5 V / 20mins = V/50
2Q1 = V/50 ; Q1 = V/100
t=? at v = 3/5 V and Q1 = V/100
V/100 = 3/5 V / t ; t = 300/5 = 60mins.
Ans ; E
www.globalcharles1.com


16. % decrease = (21/25 − 1) × 100%
= −16%
Thus 16% decrease
Ans: D


17. building = b, building's shadow = ?
tree = t, tree's shadow = x = ?
b = ?
t = x ; x = ?t / b
Ans A.



18. If x, y & z are consecutive negative integers, x > y > z

Say, x = -1, y = -2, z = -3

positive odd integer required?

A xyz = -1 × -2 × -3 = -6

B (x-y)(y-z) = (-1 - (-2))(-2 - (-3))
= 1 × 1 = 1

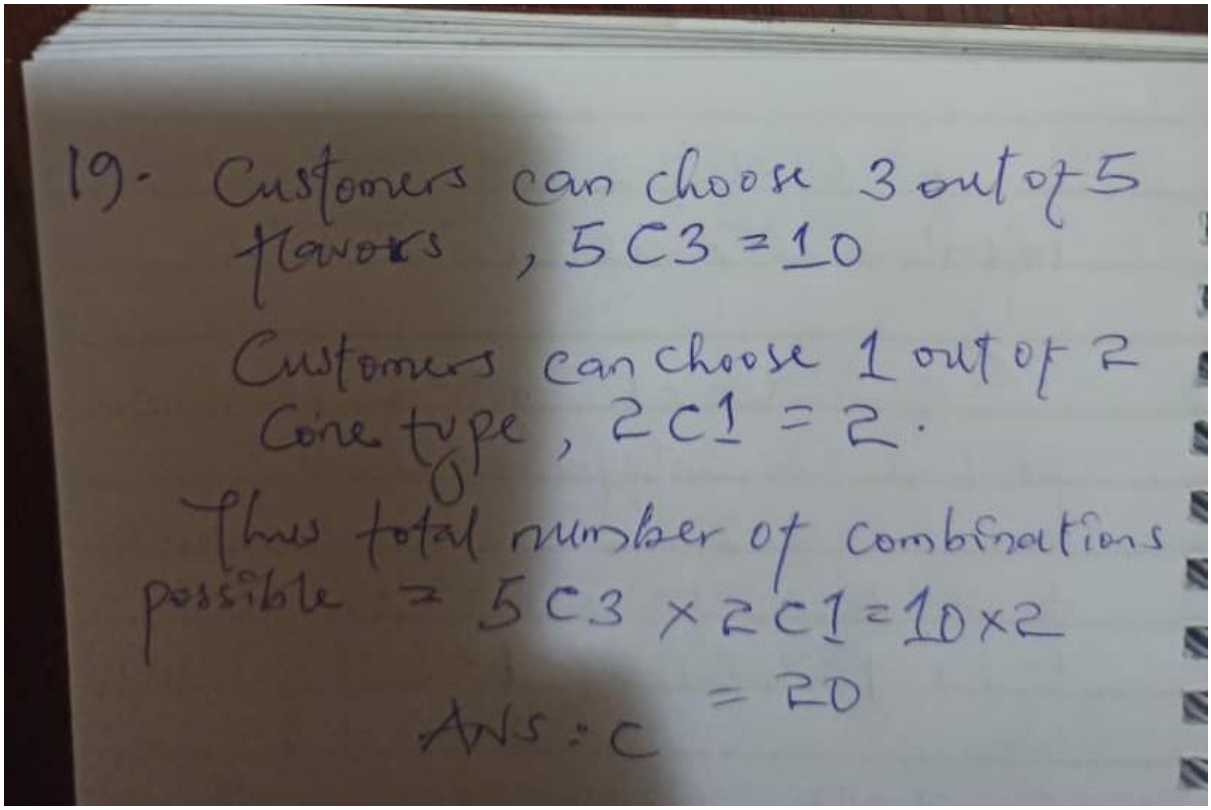
C x - yz = -1 - (-2 × -3) = -7

D x(y+z) = -1(-2-3) = +5

E x + y + z = -1 - 2 - 3 = -6

We have 2 positive odd integers B = 1 & D = 5, but the answer is B = 1 because we presumed the x, y, z to be -1, -2 & -3 respectively, but if we presume otherwise, say x = -2, y = -3 & z = -4, (B remains 1 and D changes to 14 which is not an odd integer.

Ans: B



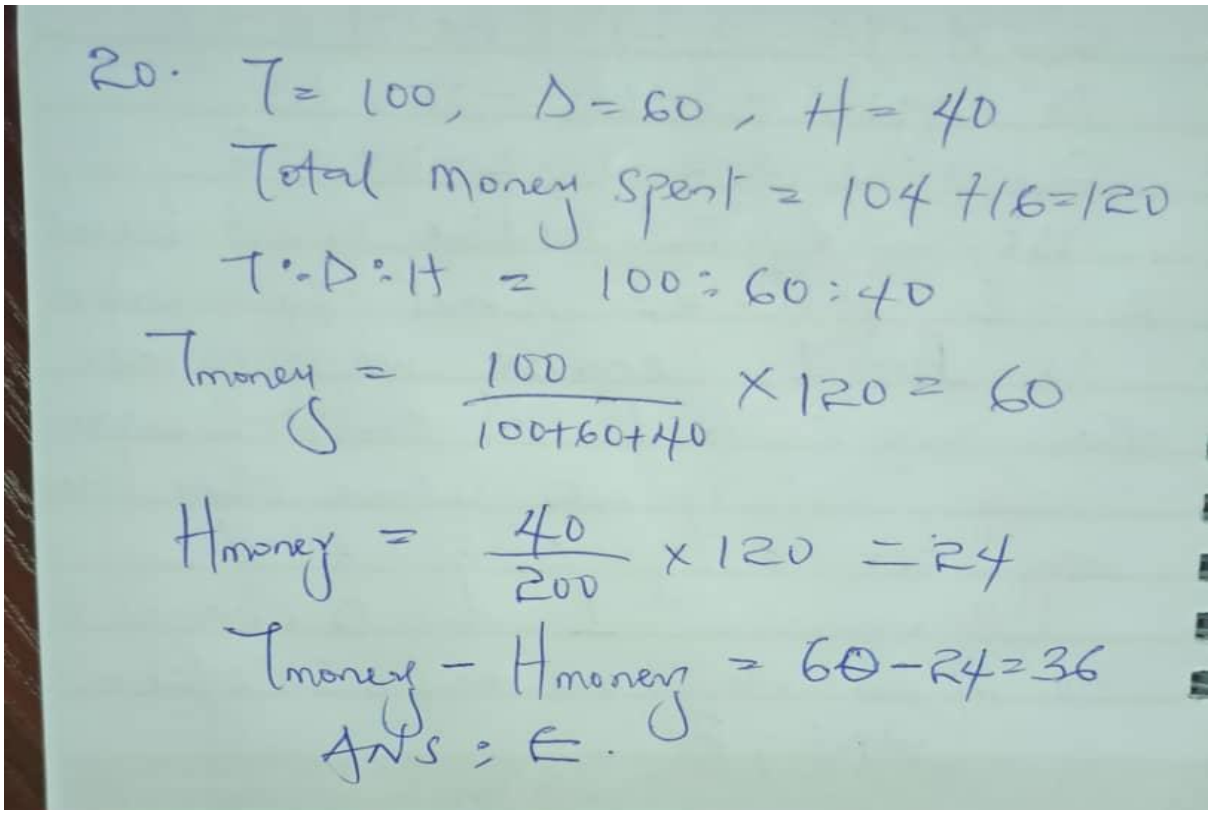
19. Customers can choose 3 out of 5 flavors, $5C3 = 10$

Customers can choose 1 out of 2 Cone type, $2C1 = 2$.

Thus total number of combinations possible $= 5C3 \times 2C1 = 10 \times 2$

$= 20$

Ans : C



20. $T = 100$, $D = 60$, $H = 40$

Total money spent $= 104 + 16 = 120$

$T : D : H = 100 : 60 : 40$

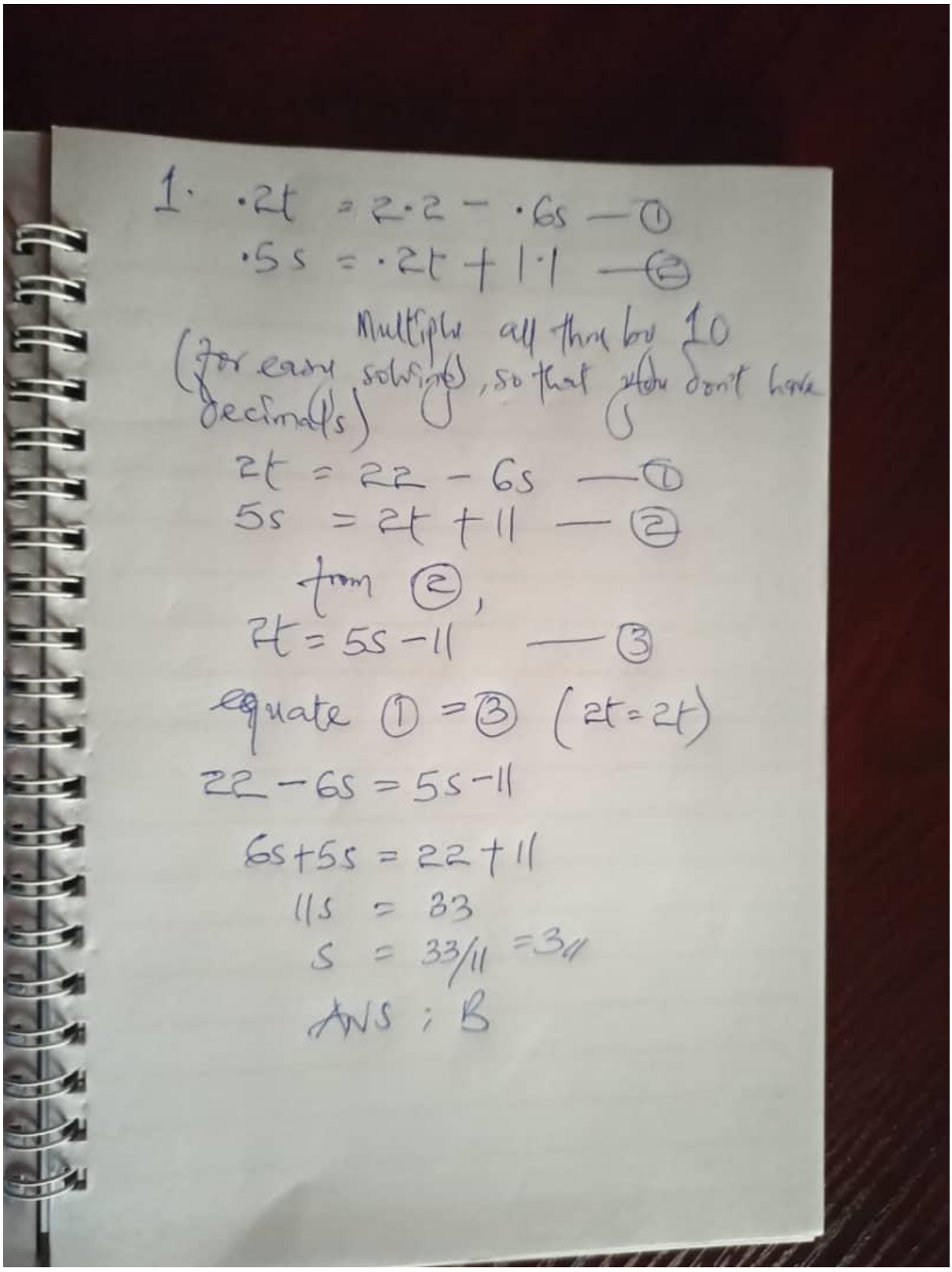
$T_{money} = \frac{100}{100+60+40} \times 120 = 60$

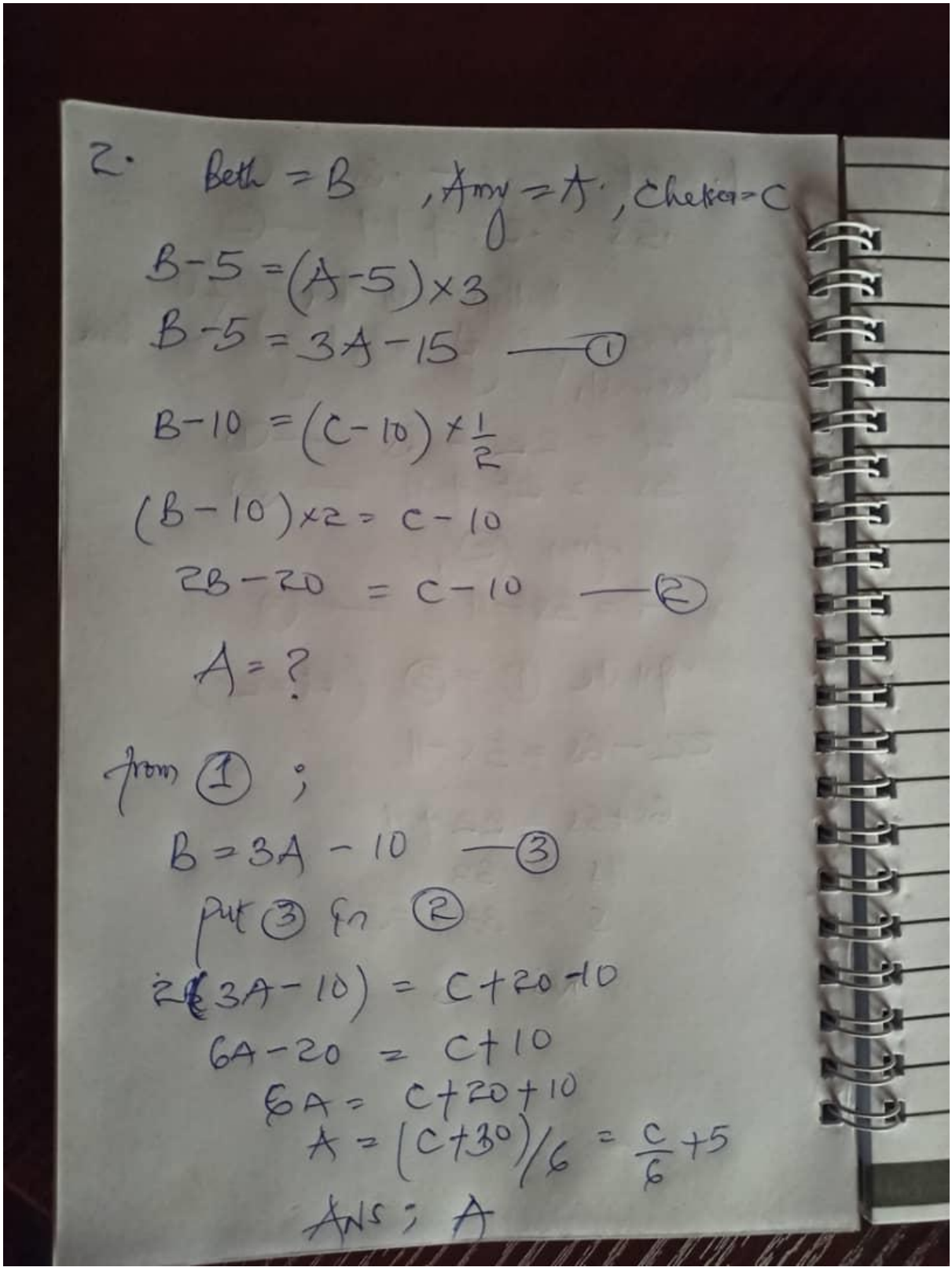
$H_{money} = \frac{40}{200} \times 120 = 24$

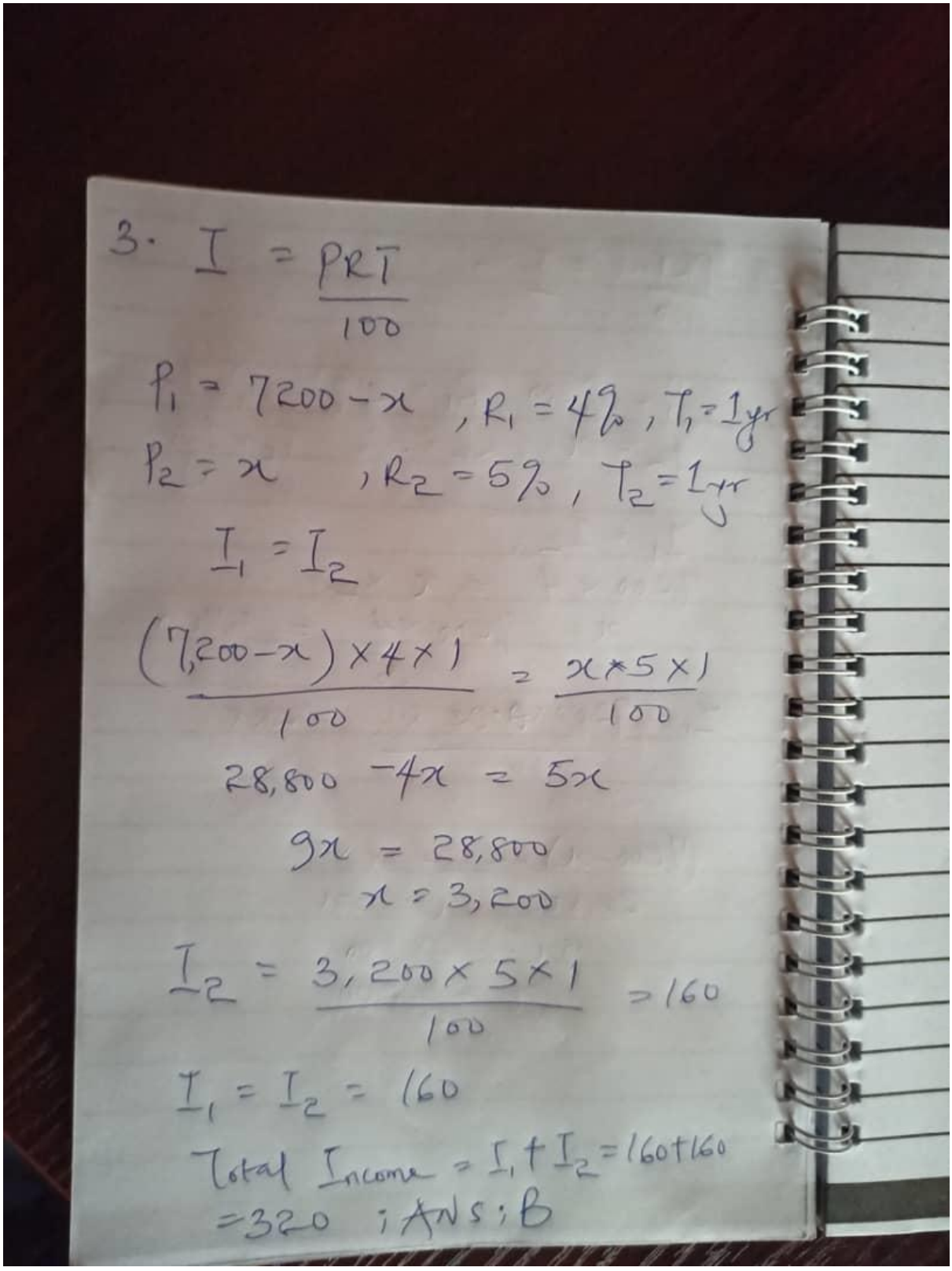
$T_{money} - H_{money} = 60 - 24 = 36$

Ans : E.

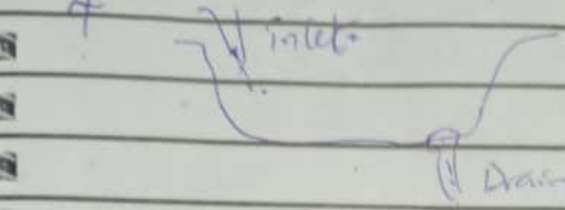
PART 2


1. ·2t = 2·2 − ·6s — ①
·5s = ·2t + 1·1 — ②
Multiply all thru by 10
(for easy solving), so that we don't have decimals
2t = 22 − 6s — ①
5s = 2t + 11 — ②
from ②,
2t = 5s − 11 — ③
equate ① = ③ (2t = 2t)
22 − 6s = 5s − 11
6s + 5s = 22 + 11
11s = 33
s = 33/11 = 3
ANS ; B


2. Beth = B , Amy = A , Chelsea = C
B-5 = (A-5) × 3
B-5 = 3A-15 —— ①
B-10 = (C-10) × 1/2
(B-10) × 2 = C-10
2B-20 = C-10 —— ②
A = ?
from ① ;
B = 3A - 10 —— ③
put ③ in ②
2(3A-10) = C+20-10
6A-20 = C+10
6A = C+20+10
A = (C+30)/6 = C/6 + 5
Ans ; A


3. $I = \frac{PRT}{100}$
$P_1 = 7200 - x$, $R_1 = 4\%$, $T_1 = 1yr$
$P_2 = x$, $R_2 = 5\%$, $T_2 = 1yr$
$I_1 = I_2$
$\frac{(7,200-x) \times 4 \times 1}{100} = \frac{x \times 5 \times 1}{100}$
$28,800 - 4x = 5x$
$9x = 28,800$
$x = 3,200$
$I_2 = \frac{3,200 \times 5 \times 1}{100} = 160$
$I_1 = I_2 = 160$
Total Income $= I_1 + I_2 = 160 + 160$
$= 320$; ANS: B

4.



It takes 3hrs to fill,
it takes 6hrs to empty,

Flow rate, $Q = \frac{\text{volume}}{\text{time}}$ (m^3/s)

Input flow rate $Q_{input} = \frac{1\ tank}{3\ hrs.}$

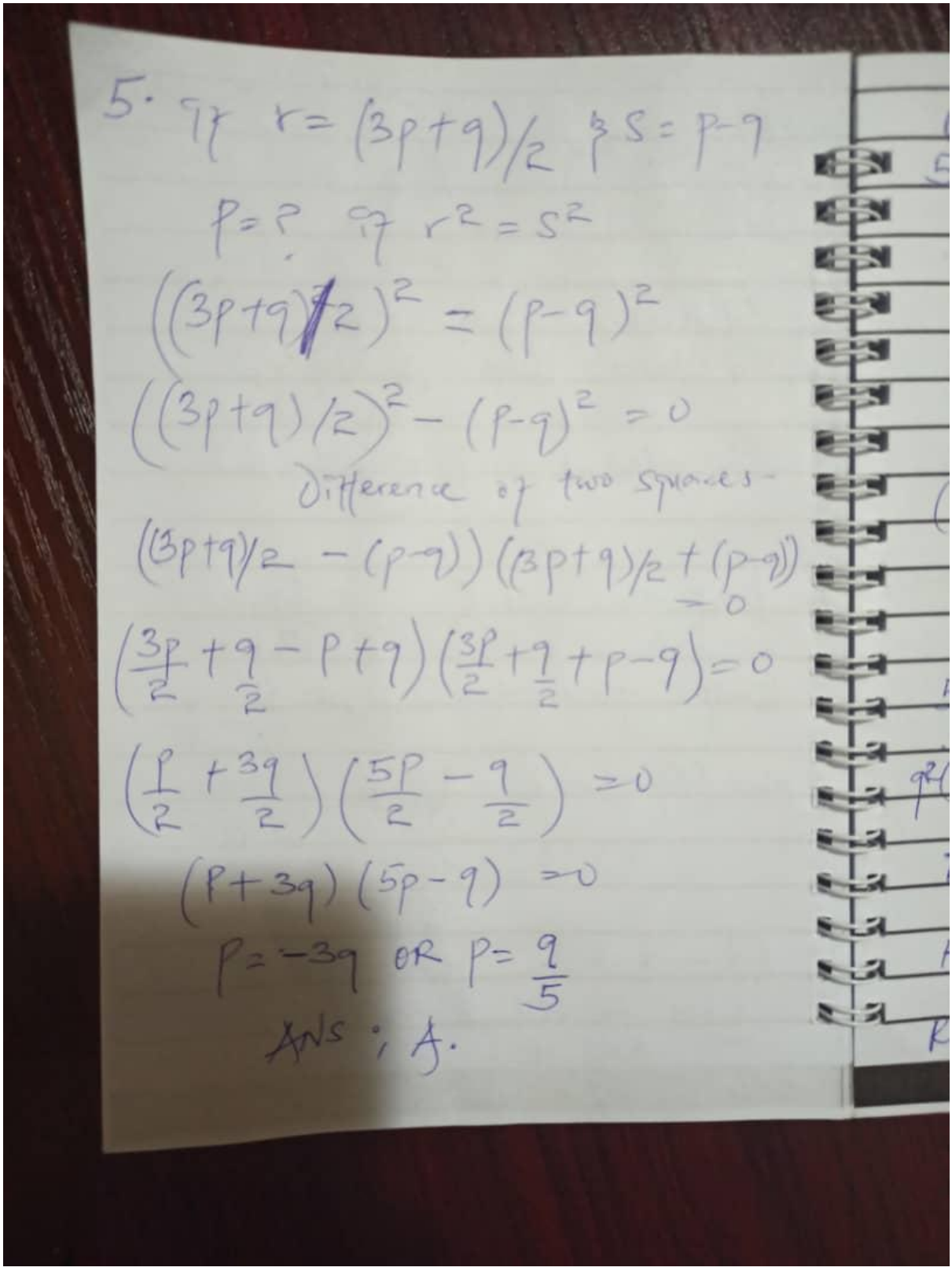
Output flow rate, $Q_{output} = \frac{1\ tank}{6\ hrs.}$

Net (input) rate $= \frac{1\ tank}{3hrs} - \frac{1\ tank}{6hrs.}$

$= \frac{1\ tank}{6\ hrs}$

$(\frac{1}{3} - \frac{1}{6} = \frac{1}{6})$, thus it will take 6hrs to fill 1 tank (pool).

∴ ANS: E.



5. If $r = (3p+q)/2$ & $s = p-q$

$p = ?$ if $r^2 = s^2$

$((3p+q)/2)^2 = (p-q)^2$

$((3p+q)/2)^2 - (p-q)^2 = 0$

Difference of two squares

$((3p+q)/2 - (p-q))((3p+q)/2 + (p-q)) = 0$

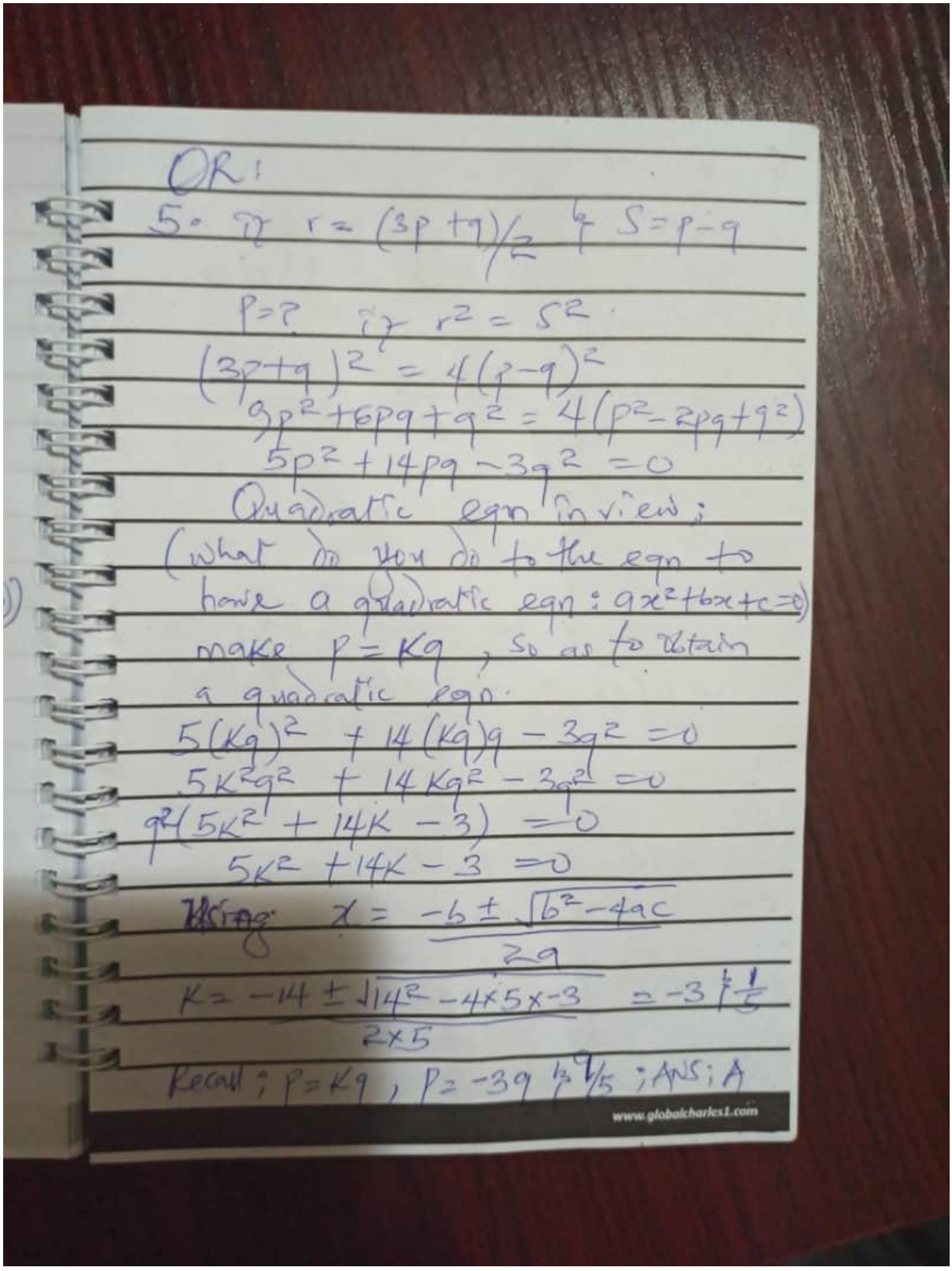
$\left(\frac{3p}{2} + \frac{q}{2} - p + q\right)\left(\frac{3p}{2} + \frac{q}{2} + p - q\right) = 0$

$\left(\frac{p}{2} + \frac{3q}{2}\right)\left(\frac{5p}{2} - \frac{q}{2}\right) = 0$

$(p+3q)(5p-q) = 0$

$p = -3q$ OR $p = \frac{q}{5}$

Ans: A.



OR:

5. If $r = (3p+q)/2$ & $S = p-q$

$P = ?$ if $r^2 = S^2$.

$(3p+q)^2 = 4(p-q)^2$

$9p^2 + 6pq + q^2 = 4(p^2 - 2pq + q^2)$

$5p^2 + 14pq - 3q^2 = 0$

Quadratic eqn in view;

(what do you do to the eqn to have a quadratic eqn: $ax^2 + bx + c = 0$)

make $p = Kq$, so as to obtain a quadratic eqn.

$5(Kq)^2 + 14(Kq)q - 3q^2 = 0$

$5K^2q^2 + 14Kq^2 - 3q^2 = 0$

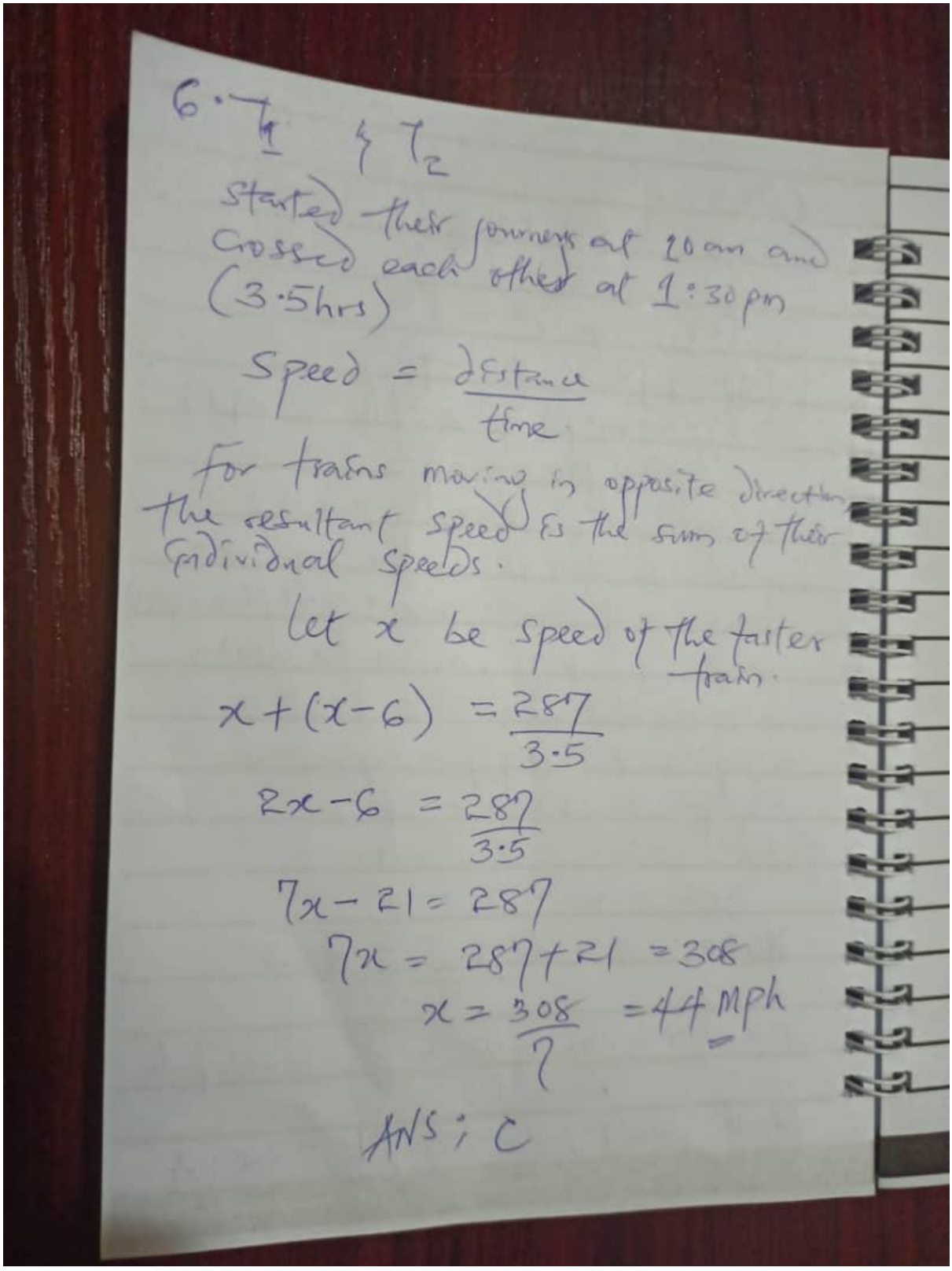
$q^2(5K^2 + 14K - 3) = 0$

$5K^2 + 14K - 3 = 0$

Using: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$K = \frac{-14 \pm \sqrt{14^2 - 4 \times 5 \times -3}}{2 \times 5} = -3 \text{ or } \frac{1}{5}$

Recall; $P = Kq$, $P = -3q$ or $\frac{q}{5}$; ANS: A



6. T_1 & T_2

started their journeys at 10 am and crossed each other at 1:30 pm (3.5 hrs)

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

For trains moving in opposite direction, the resultant speed is the sum of their individual speeds.

Let x be speed of the faster train.

$$x + (x-6) = \frac{287}{3.5}$$

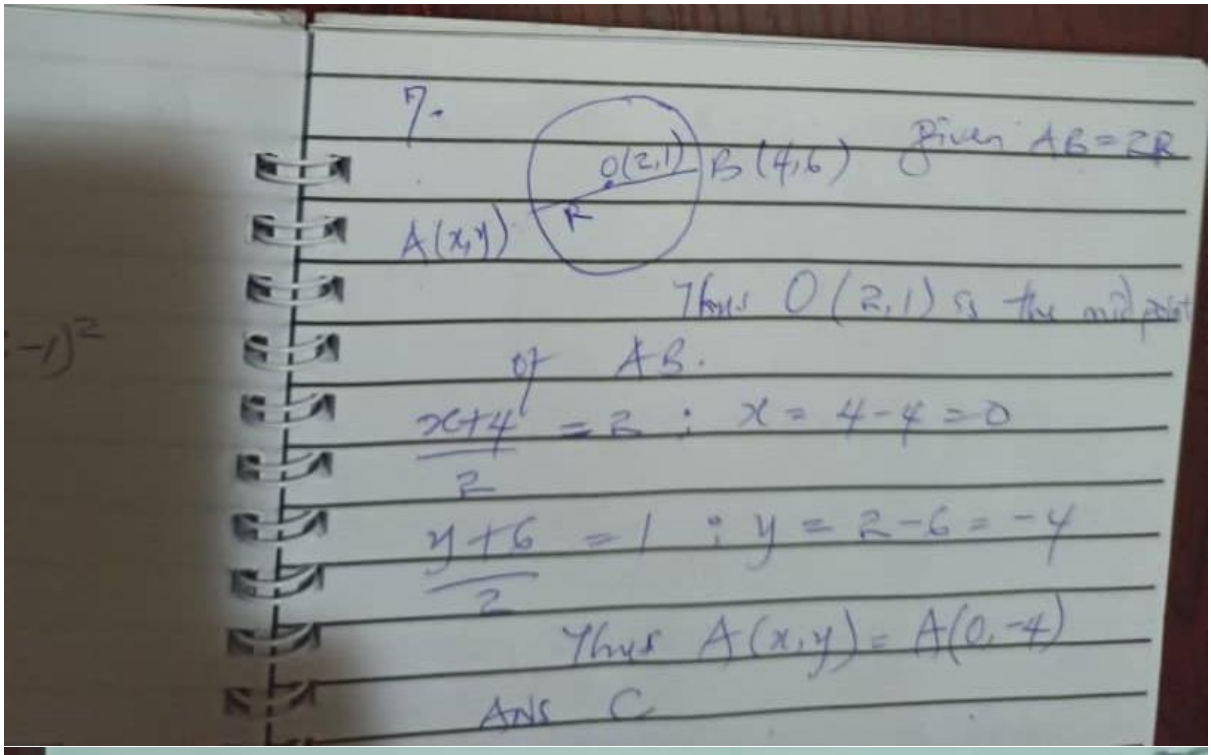
$$2x - 6 = \frac{287}{3.5}$$

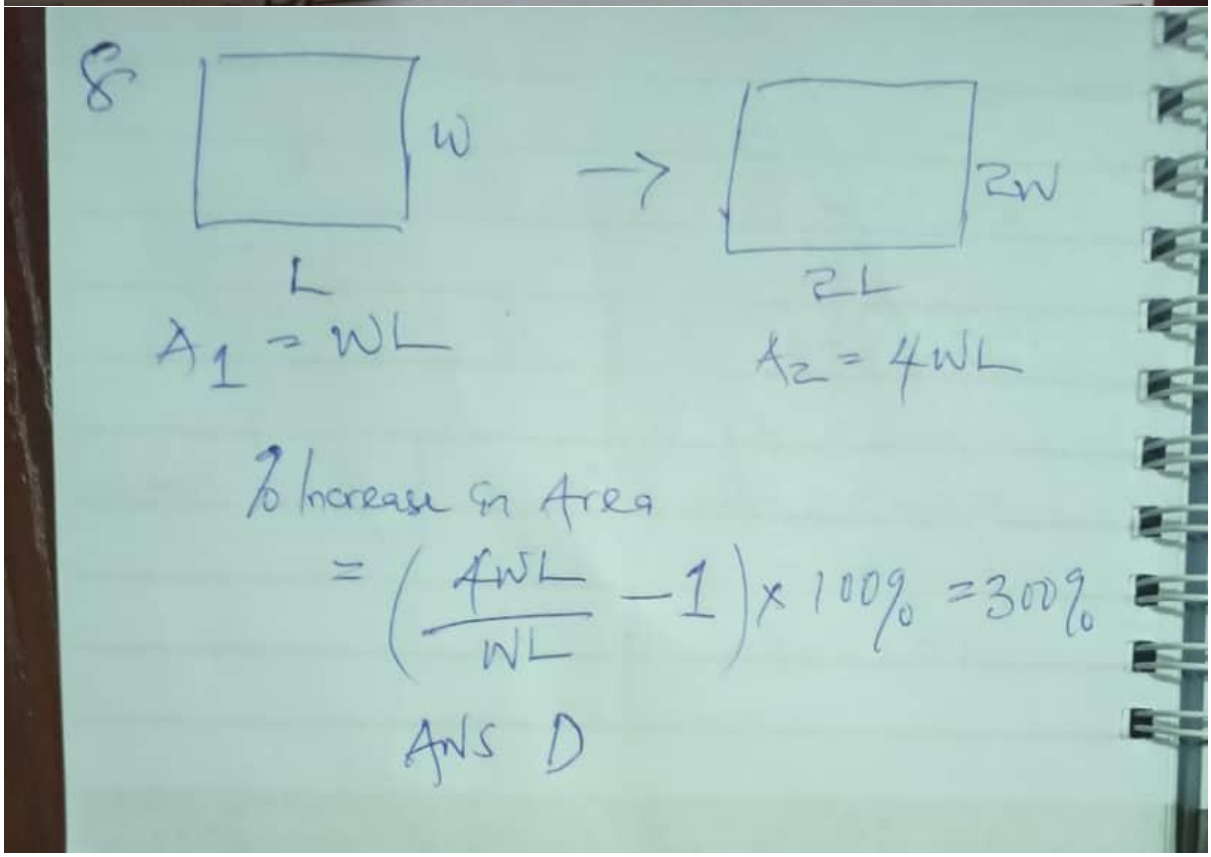
$$7x - 21 = 287$$

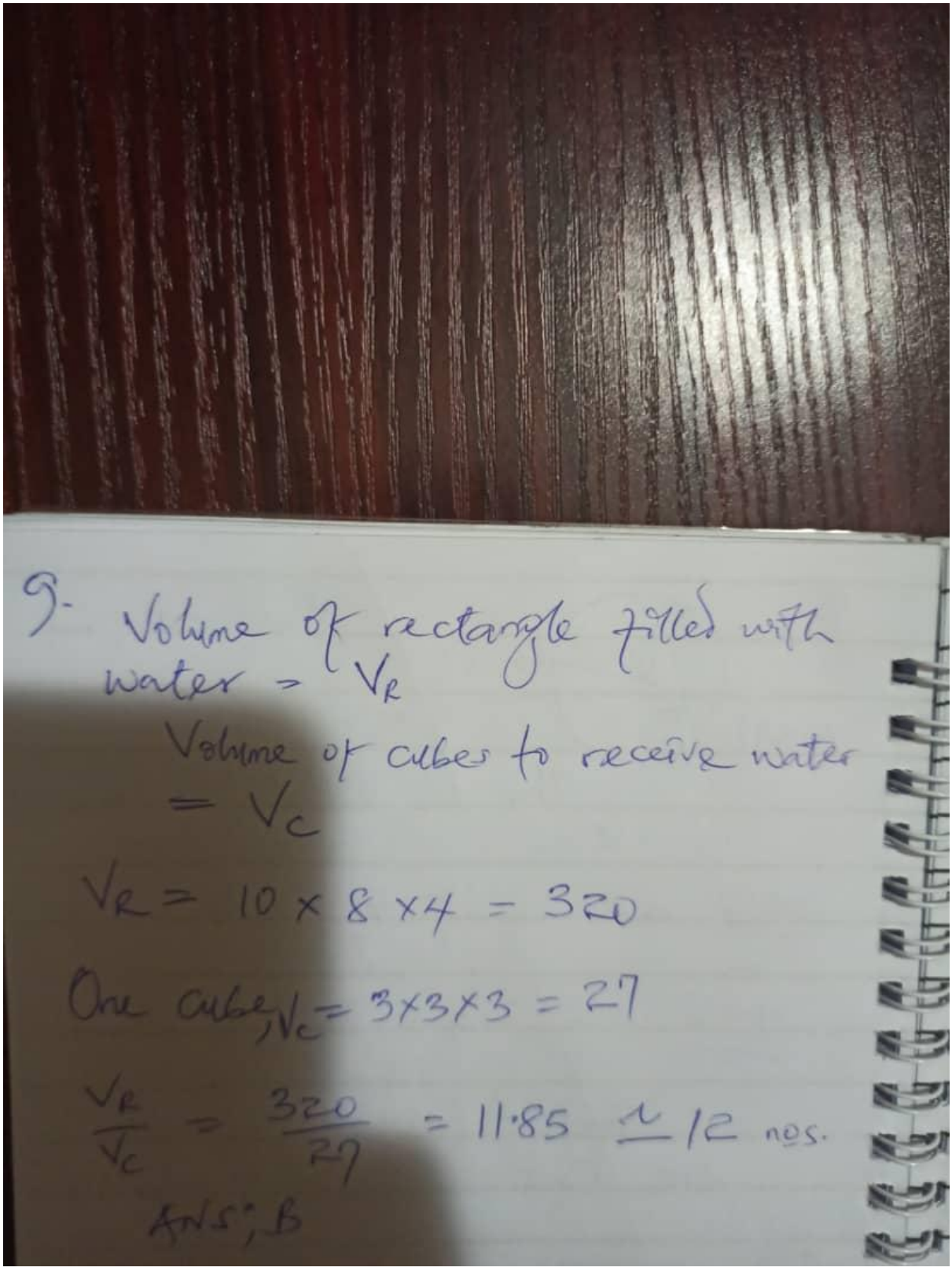
$$7x = 287 + 21 = 308$$

$$x = \frac{308}{7} = 44 \text{ mph}$$

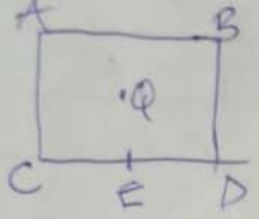
ANS: C

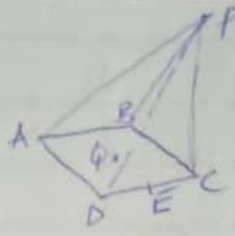

7.
O(2,1)
B(4,6)
A(x,y)
R
Given AB = 2R
Thus O(2,1) is the midpoint of AB.
$\frac{x+4}{2} = 2 \; ; \; x = 4-4 = 0$
$\frac{y+6}{2} = 1 \; ; \; y = 2-6 = -4$
Thus A(x,y) = A(0,-4)
Ans C


8
W
L
2W
2L
$A_1 = WL$
$A_2 = 4WL$
% Increase in Area
$= \left(\frac{4WL}{WL} - 1\right) \times 100\% = 300\%$
Ans D


9. Volume of rectangle filled with water = V_R
Volume of cubes to receive water = V_C
$V_R = 10 \times 8 \times 4 = 320$
One cube, $V_C = 3 \times 3 \times 3 = 27$
$\frac{V_R}{V_C} = \frac{320}{27} = 11.85 \approx 12$ nos.
Ans; B

10.





$\angle PAB : \angle PQE$ required.

Given $PQ = \frac{AB}{2}$

Let $PQ = y$ & $AB = x$ $\left(y = \frac{x}{2}\right)$

$\angle PAB : \angle PQE$ (Area of triangle = 1/2 × base × height)

$\frac{1}{2} \times x \times \sqrt{y^2 + \left(\frac{x}{2}\right)^2} : \frac{1}{2} \times \frac{x}{2} \times y$

$\frac{x}{2}\sqrt{y^2 + \frac{x^2}{4}} : \frac{xy}{4}$

but $y = \frac{x}{2}$

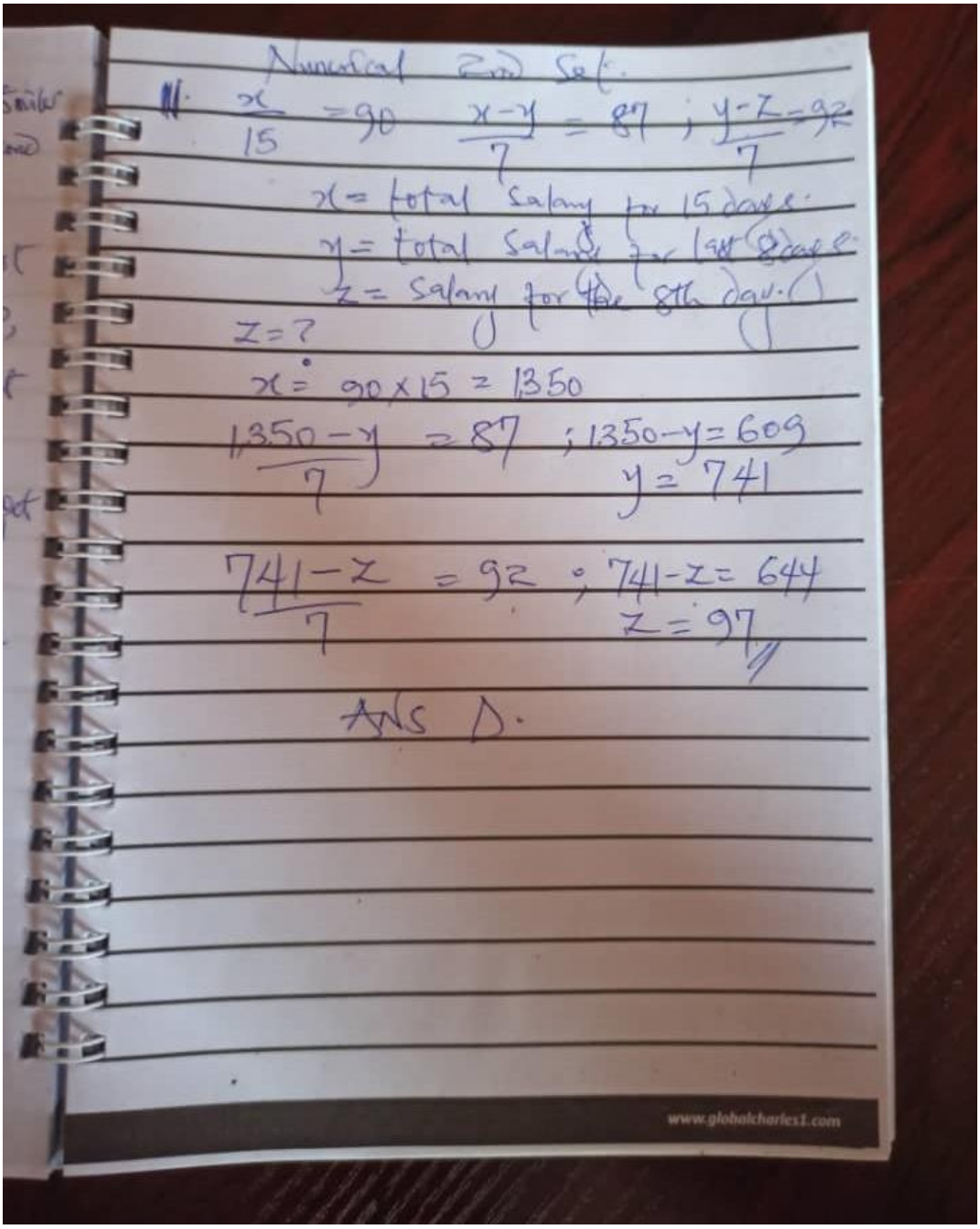
$\frac{x}{2}\sqrt{\left(\frac{x}{2}\right)^2 + \frac{x^2}{4}} : \frac{x}{4} \times \frac{x}{2}$

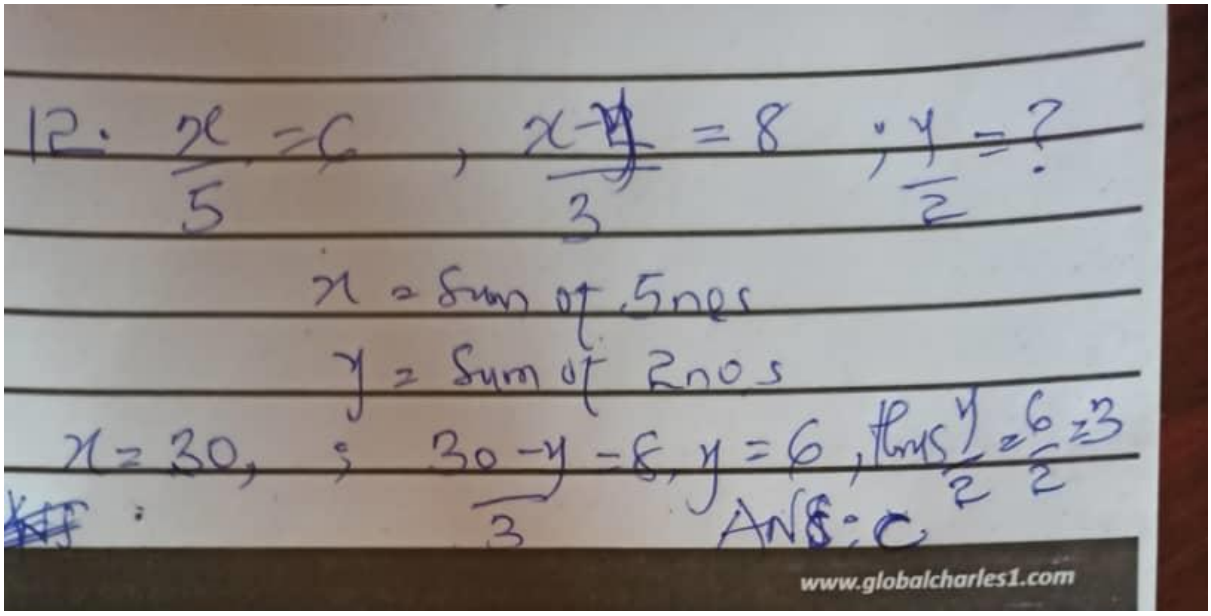
$\frac{x}{2}\sqrt{\frac{2x^2}{4}} : \frac{x^2}{8}$

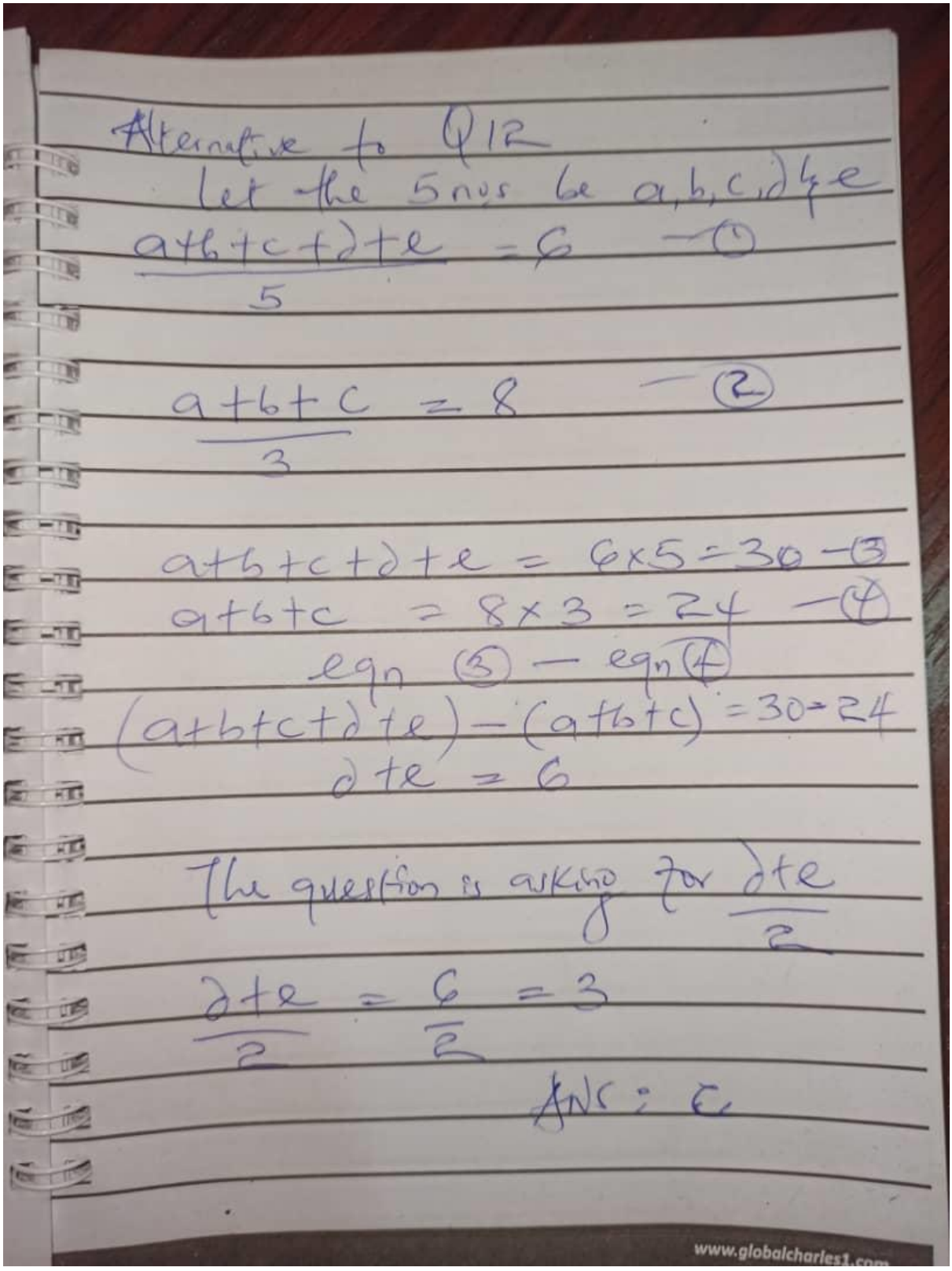
$\frac{x}{2} \times \frac{x}{2}\sqrt{2} : \frac{x^2}{8}$

$\sqrt{2} : \frac{1}{2}$

$2\sqrt{2} : 1$ ANS D


Numerical 2nd Set.
11. x/15 = 90 (x-y)/7 = 87 ; (y-z)/7 = 92
x = total salary for 15 days.
y = total salary for last 8 days.
z = salary for the 8th day.
z = ?
x = 90 × 15 = 1350
(1350-y)/7 = 87 ; 1350-y = 609
y = 741
(741-z)/7 = 92 ; 741-z = 644
z = 97
Ans D.
www.globalcharles1.com


12. $\frac{x}{5} = 6$, $\frac{x-y}{3} = 8$; $\frac{y}{2} = ?$
x = Sum of 5nos
y = Sum of 2nos
$x = 30$, $\frac{30-y}{3} = 8$, $y = 6$, $\frac{y}{2} = \frac{6}{2} = 3$
Ans: C
www.globalcharles1.com



Alternative to Q12

Let the 5 nos be a, b, c, d & e

$\frac{a+b+c+d+e}{5} = 6$ — (1)

$\frac{a+b+c}{3} = 8$ — (2)

$a+b+c+d+e = 6 \times 5 = 30$ — (3)

$a+b+c = 8 \times 3 = 24$ — (4)

eqn (3) − eqn (4)

$(a+b+c+d+e) - (a+b+c) = 30 - 24$

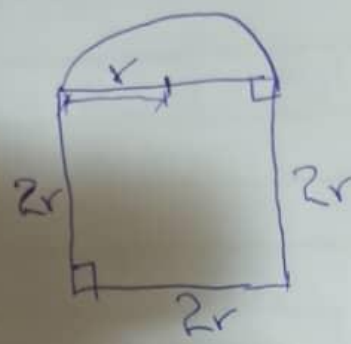
$d+e = 6$

The question is asking for $\frac{d+e}{2}$

$\frac{d+e}{2} = \frac{6}{2} = 3$

ANS: C

13.



Area of Semicircle $= \frac{\pi r^2}{2}$

Area of Square $= (2r)^2 = 4r^2$

$\frac{\pi r^2}{2} : 4r^2$

$\pi : 8$; Ans ; C

14. 40% of 30 = 12

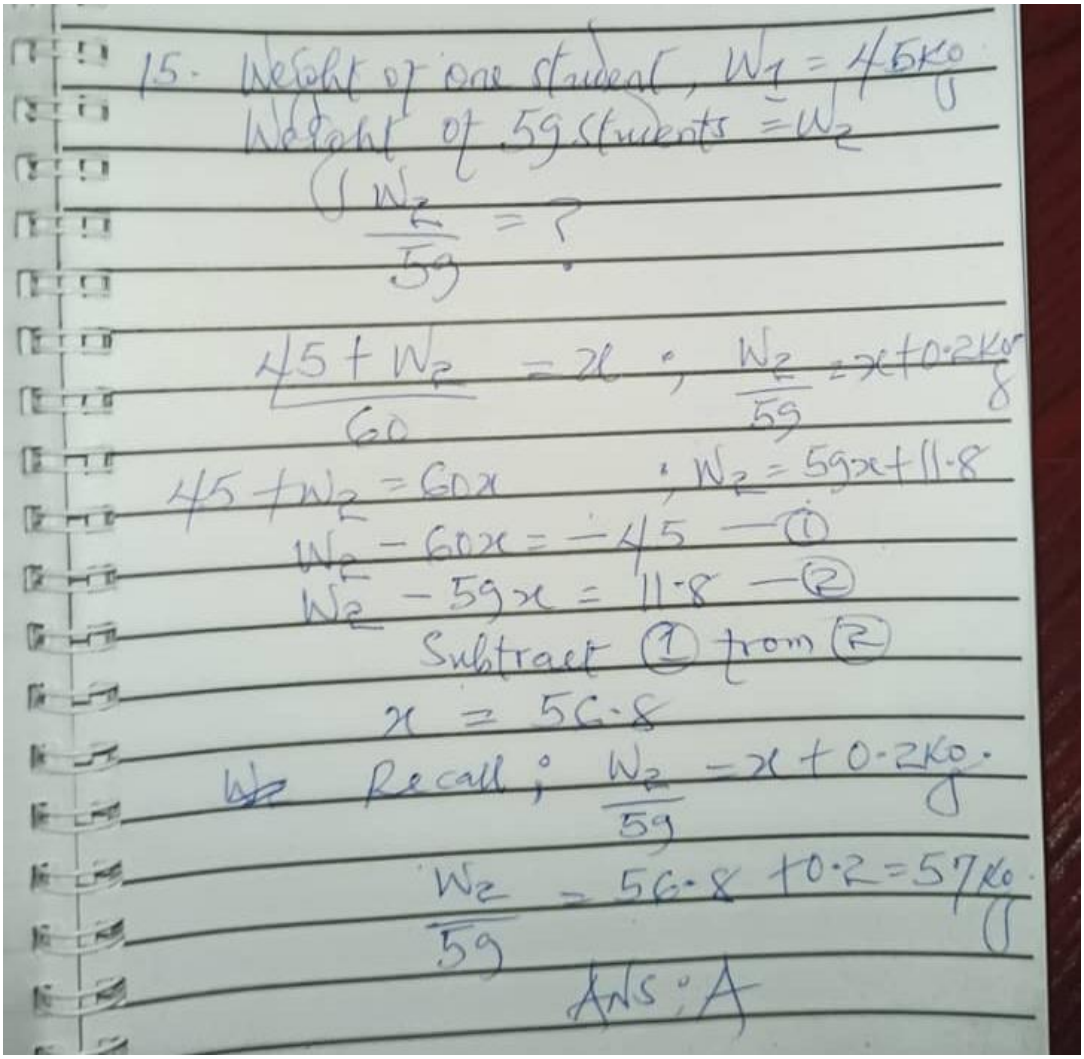
3/5 of 25 = 15

6.5% of 200 = 13

$5 + \sqrt{3}$ = 6.73

$(1/2)^{-4}$ = 16

Thus Ans ; E


15. Weight of one student, $W_1 = 45Kg$
Weight of 59 students $= W_2$
$\frac{W_2}{59} = ?$

$\frac{45 + W_2}{60} = x$; $\frac{W_2}{59} = x + 0.2Kg$

$45 + W_2 = 60x$; $W_2 = 59x + 11.8$

$W_2 - 60x = -45$ — (1)

$W_2 - 59x = 11.8$ — (2)

Subtract (1) from (2)

$x = 56.8$

Recall; $\frac{W_2}{59} = x + 0.2Kg$

$\frac{W_2}{59} = 56.8 + 0.2 = 57Kg$

Ans: A

16- Let X, Y, & Z be the total scores in the 3 classes respectively.
Let a, b & c be the total nos of students in the 3 classes resp.

$\frac{X}{a} = 83$; $X = 83a$; $\frac{Y}{b} = 76$, $Y = 76b$; $Z = \frac{85}{c}$

$Z = 85c$.

$\frac{X+Y}{a+b} = 79$; $\frac{Y+Z}{b+c} = 81$, $\frac{X+Y+Z}{a+b+c} = ?$

$\frac{83a+76b}{a+b} = 79$, $\frac{76b+85c}{b+c} = 81$

$83a + 76b = 79a + 79b$; $76b + 85c = 81b + 81c$

$4a = 3b$; $5b = 4c$

$a = \frac{3}{4}b$; $c = \frac{5}{4}b$.

(b is the connection of the 2 eqns, thus should be channeled to b)

$\frac{X+Y+Z}{a+b+c} = ? = \frac{83a+76b+85c}{a+b+c}$

$= \frac{83 \times \frac{3}{4}b + 76b + 85 \times \frac{5}{4}b}{\frac{3}{4}b + b + \frac{5}{4}b} = \frac{\frac{249}{4}b + \frac{304}{4}b}{\frac{12}{4}b} = \frac{\left(\frac{978}{4}\right)b}{\left(\frac{12}{4}\right)b} = 81.5$

ANS: B

17. W = Weight of 24 students.
W_T = Weight of teacher. = ?

$\frac{W}{24} = 36\text{kg}$; $W = 36 \times 24 = 864\text{kg}$

$\frac{864 + W_T}{25} = 36 + 1 = 37$

$W_T = 37 \times 25 - 864 = 61\text{kg}$

Ans B

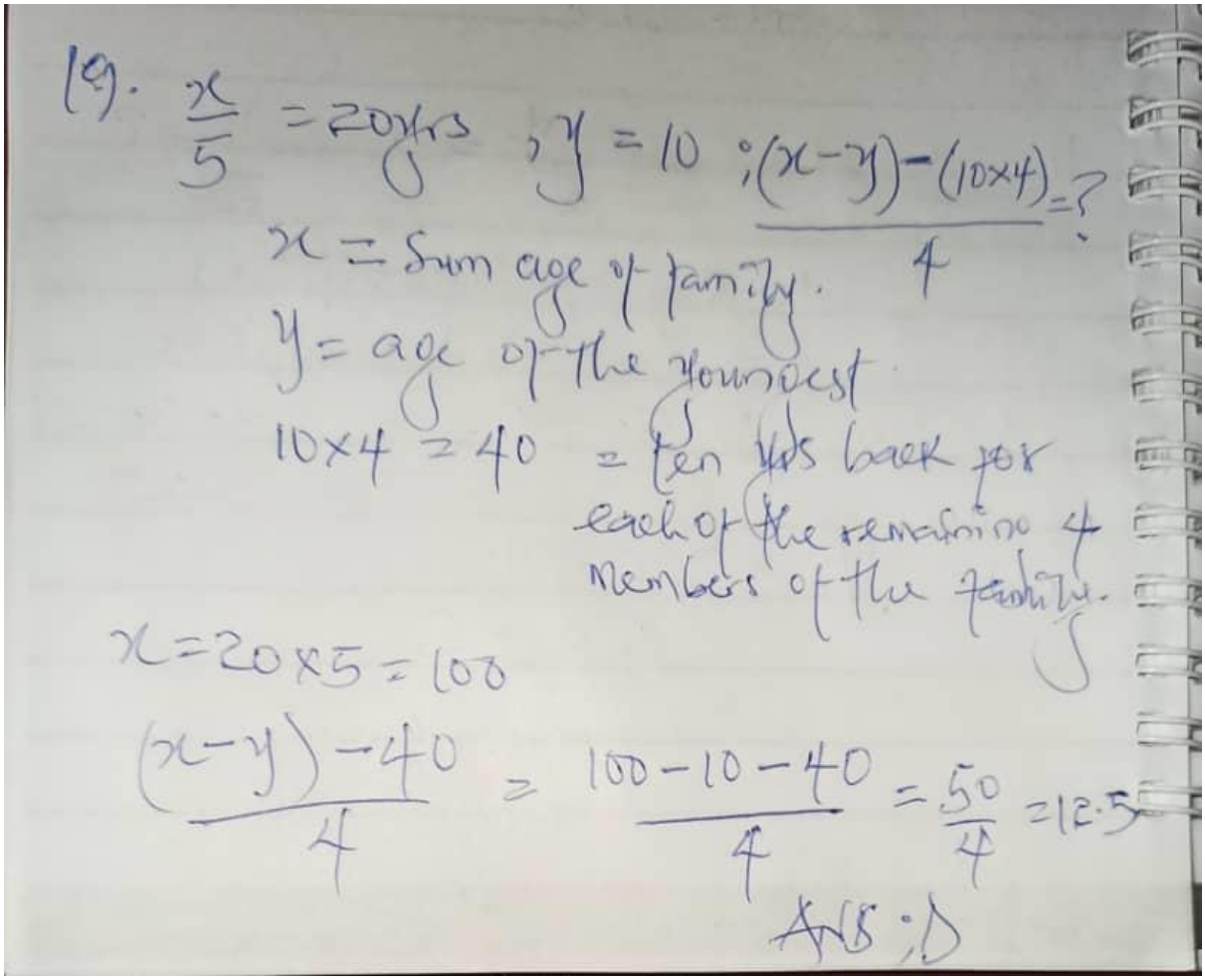
18. $\frac{x}{5} = 10$; $\frac{x-y}{3} = 9$; $\frac{y}{2} = ?$

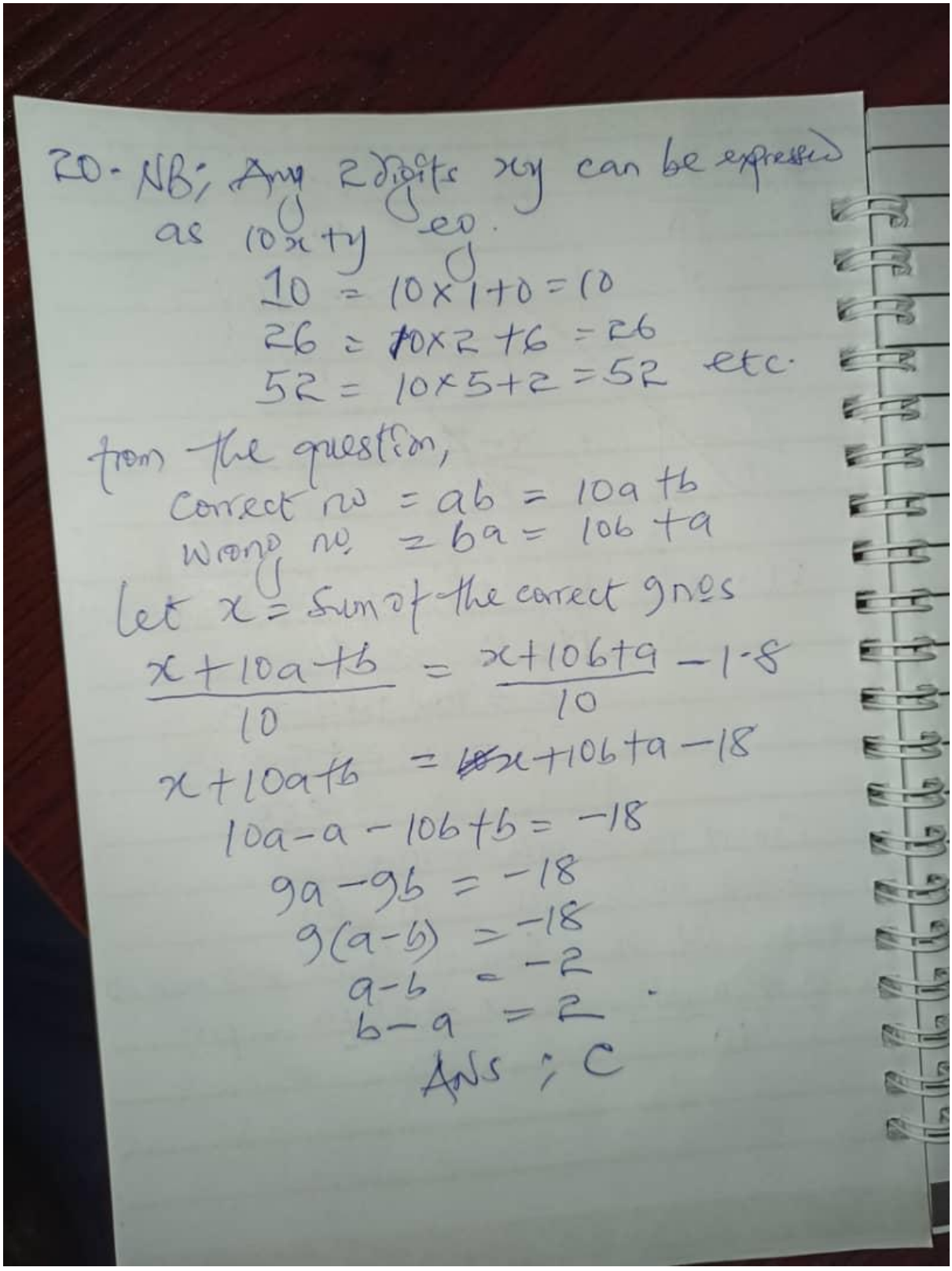
x = Sum of 5 quantities.
y = Sum of 2 quantities.

$x = 50$; $\frac{50-y}{3} = 9$; $y = 50 - 27$
$= 23$

$y/2 = 23/2 = 11.5$

Ans : C


19. x/5 = 20yrs ; y = 10 ; (x-y)-(10×4) / 4 = ?
x = Sum age of family.
y = age of the youngest
10×4 = 40 = ten yrs back for each of the remaining 4 members of the family.
x = 20×5 = 100
(x-y)-40 / 4 = 100-10-40 / 4 = 50/4 = 12.5
Ans: D



20. NB; Any 2 digits xy can be expressed as $10x + y$ eg.

$10 = 10 \times 1 + 0 = 10$

$26 = 10 \times 2 + 6 = 26$

$52 = 10 \times 5 + 2 = 52$ etc.

from the question,

Correct no $= ab = 10a + b$

Wrong no $= ba = 10b + a$

let x = Sum of the correct nos

$$\frac{x + 10a + b}{10} = \frac{x + 10b + a}{10} - 1.8$$

$$x + 10a + b = x + 10b + a - 18$$

$$10a - a - 10b + b = -18$$

$$9a - 9b = -18$$

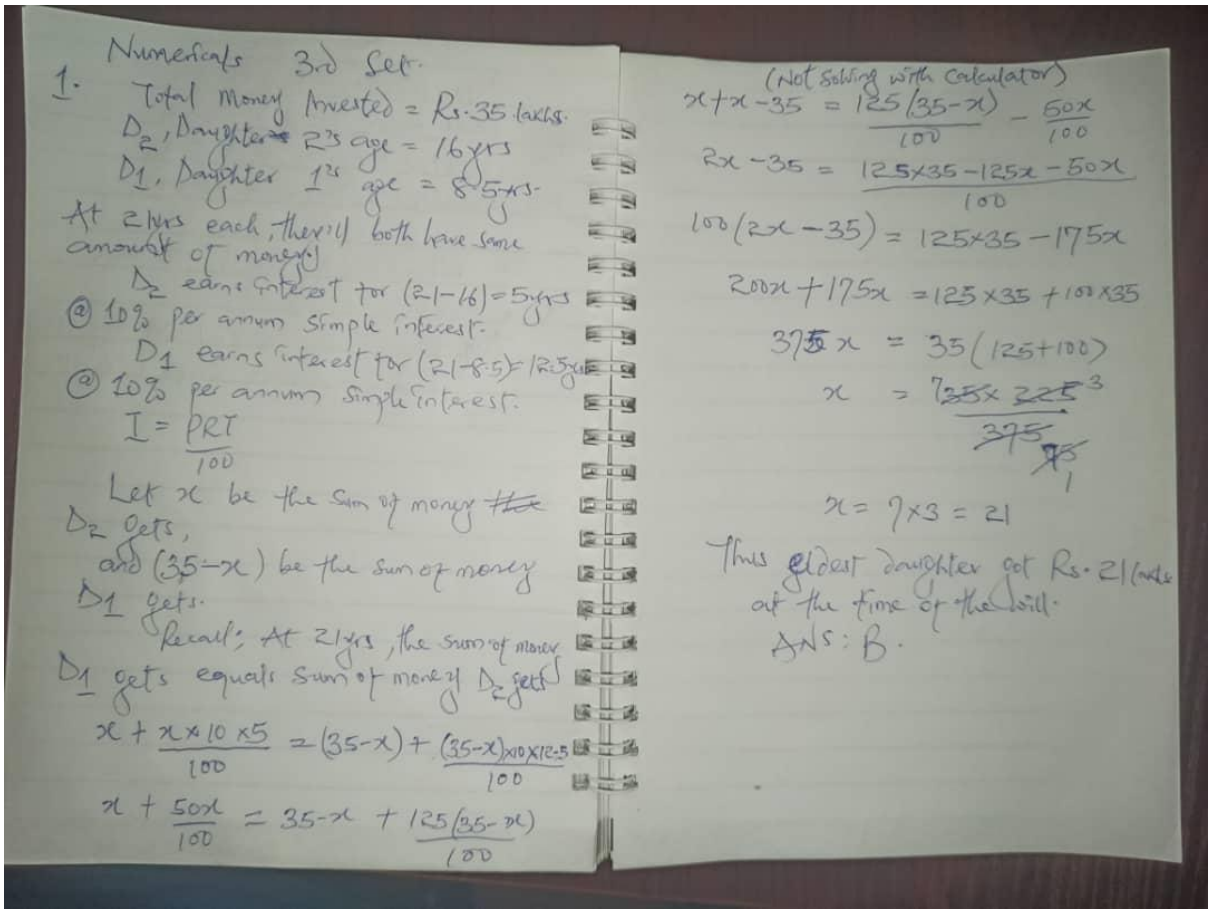
$$9(a - b) = -18$$

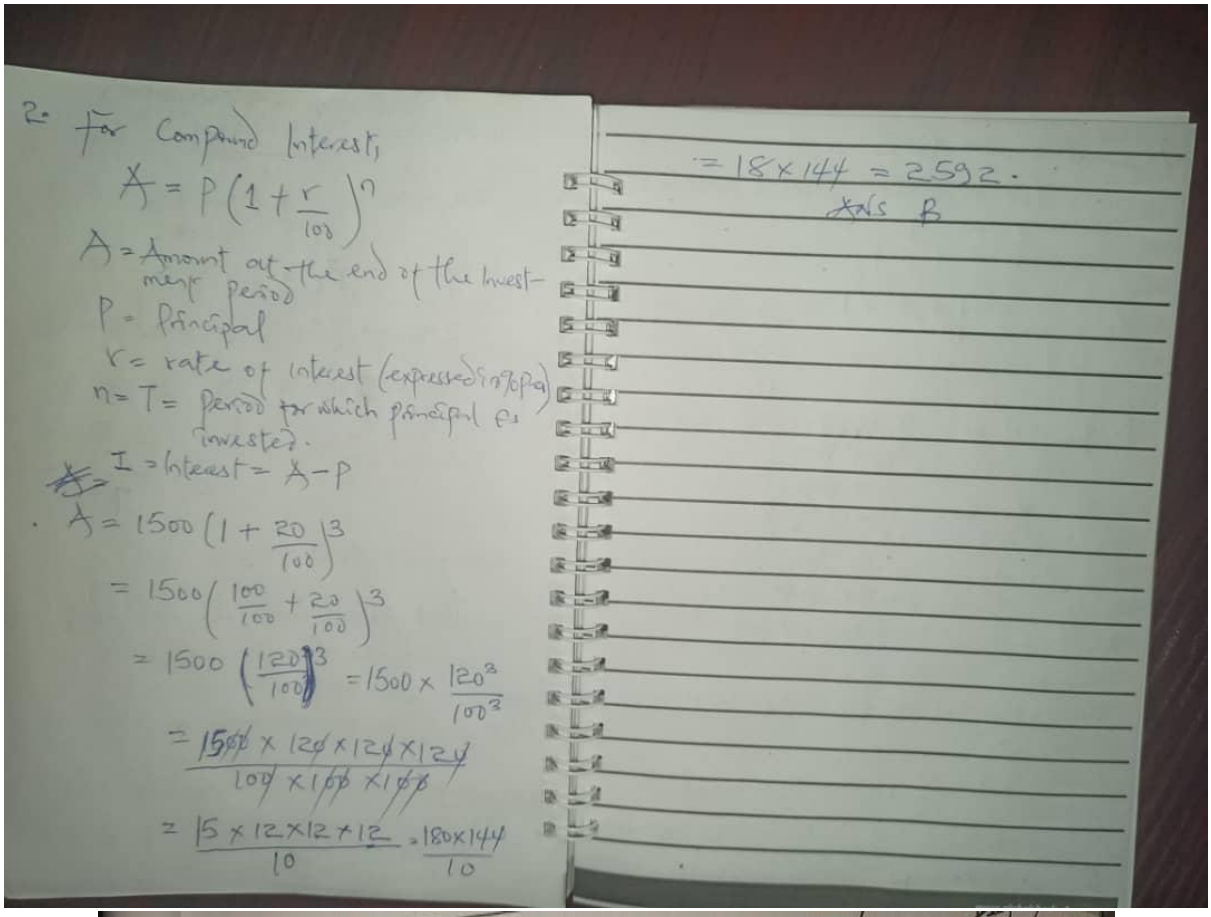
$$a - b = -2$$

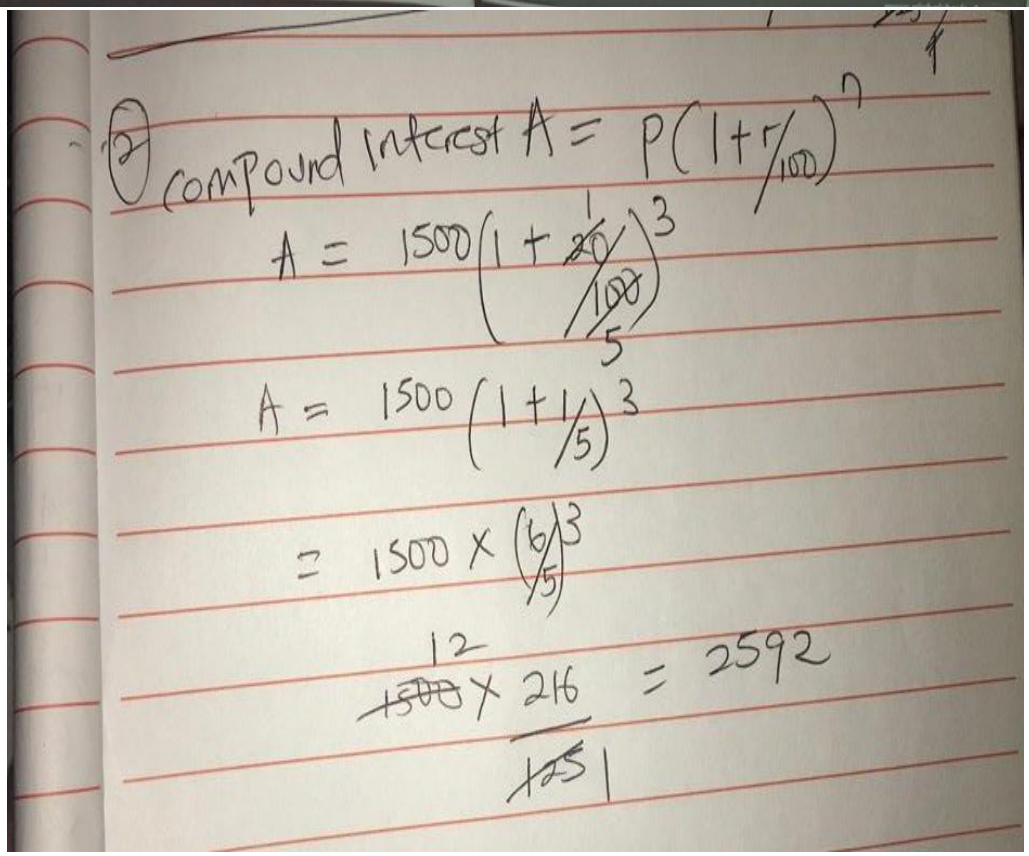
$$b - a = 2$$

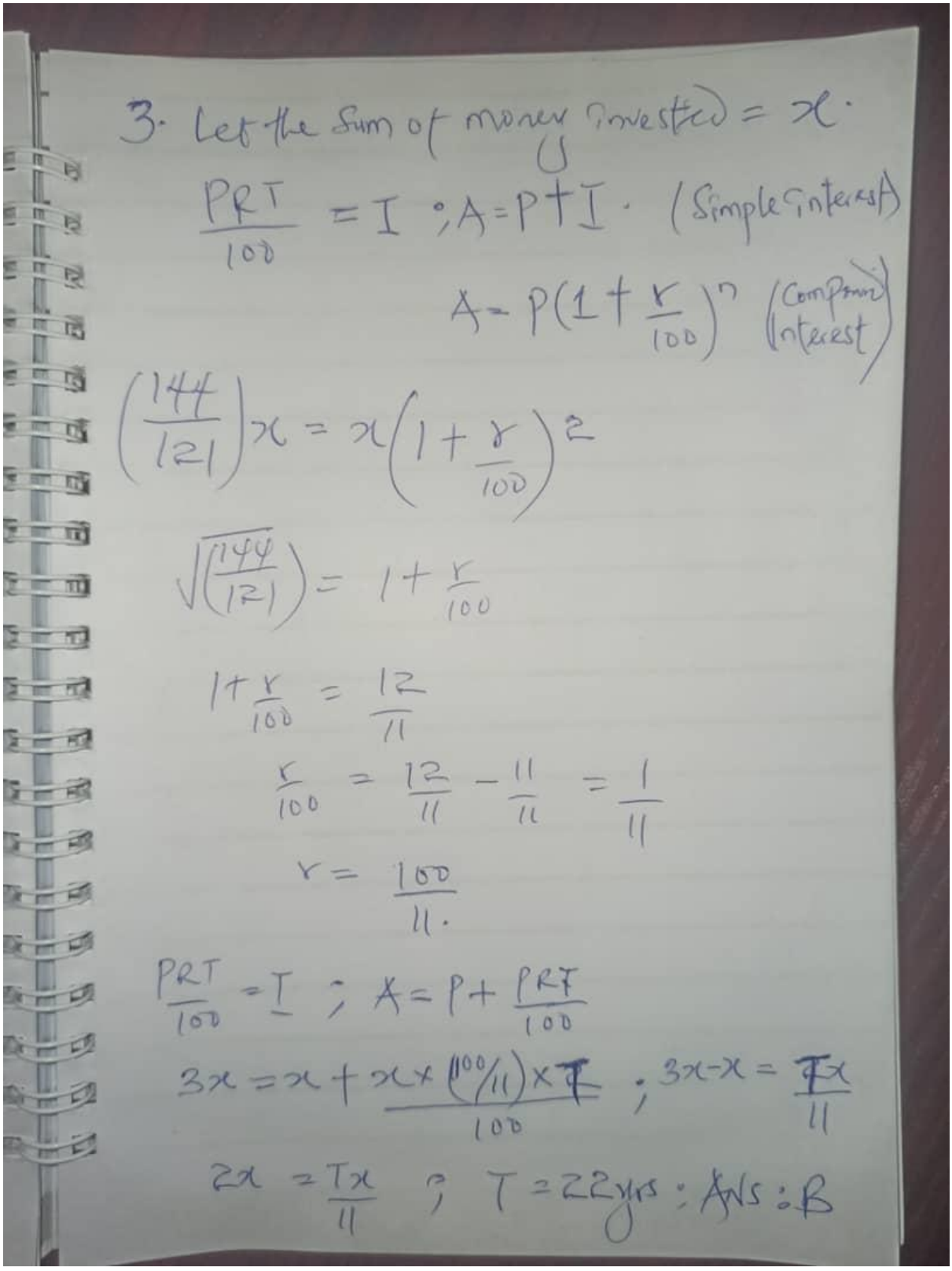
Ans ; C

Part 3


Numericals 3rd Set.
1. Total Money Invested = Rs. 35 lakhs.
D2, Daughter 2's age = 16 yrs
D1, Daughter 1's age = 8.5 yrs.
At 21 yrs each, they'll both have same amount of money.
D2 earns interest for (21-16) = 5 yrs
@ 10% per annum simple interest.
D1 earns interest for (21-8.5) = 12.5 yrs
@ 10% per annum simple interest.
I = PRT / 100
Let x be the sum of money D2 gets,
and (35-x) be the sum of money D1 gets.
Recall; At 21 yrs, the sum of money D1 gets equals sum of money D2 gets
x + x×10×5/100 = (35-x) + (35-x)×10×12.5/100
x + 50x/100 = 35-x + 125(35-x)/100
(Not solving with calculator)
x + x - 35 = 125(35-x)/100 - 50x/100
2x - 35 = (125×35 - 125x - 50x)/100
100(2x - 35) = 125×35 - 175x
200x + 175x = 125×35 + 100×35
375x = 35(125+100)
x = 7×225×3/375
x = 7×3 = 21
Thus eldest daughter got Rs. 21 lakhs at the time of the bill.
Ans: B.


2. For Compound Interest,
$A = P\left(1 + \frac{r}{100}\right)^n$
A = Amount at the end of the investment period
P = Principal
r = rate of interest (expressed in % p.a)
n = T = period for which principal is invested.
I = Interest = A − P
$A = 1500\left(1 + \frac{20}{100}\right)^3$
$= 1500\left(\frac{100}{100} + \frac{20}{100}\right)^3$
$= 1500\left(\frac{120}{100}\right)^3 = 1500 \times \frac{120^3}{100^3}$
$= \frac{15 \times 12 \times 12 \times 12}{10} = \frac{180 \times 144}{10}$
$= 18 \times 144 = 2592.$
Ans B


(2) Compound Interest $A = P(1 + r/100)^n$
$A = 1500\left(1 + \frac{20}{100}\right)^3$
$A = 1500\left(1 + \frac{1}{5}\right)^3$
$= 1500 \times \left(\frac{6}{5}\right)^3$
$\frac{12}{1500} \times \frac{216}{125} = 2592$



3. Let the sum of money invested = x.

$\frac{PRT}{100} = I$; $A = P + I$. (Simple interest)

$A = P\left(1 + \frac{r}{100}\right)^n$ (Compound interest)

$\left(\frac{144}{121}\right)x = x\left(1 + \frac{r}{100}\right)^2$

$\sqrt{\left(\frac{144}{121}\right)} = 1 + \frac{r}{100}$

$1 + \frac{r}{100} = \frac{12}{11}$

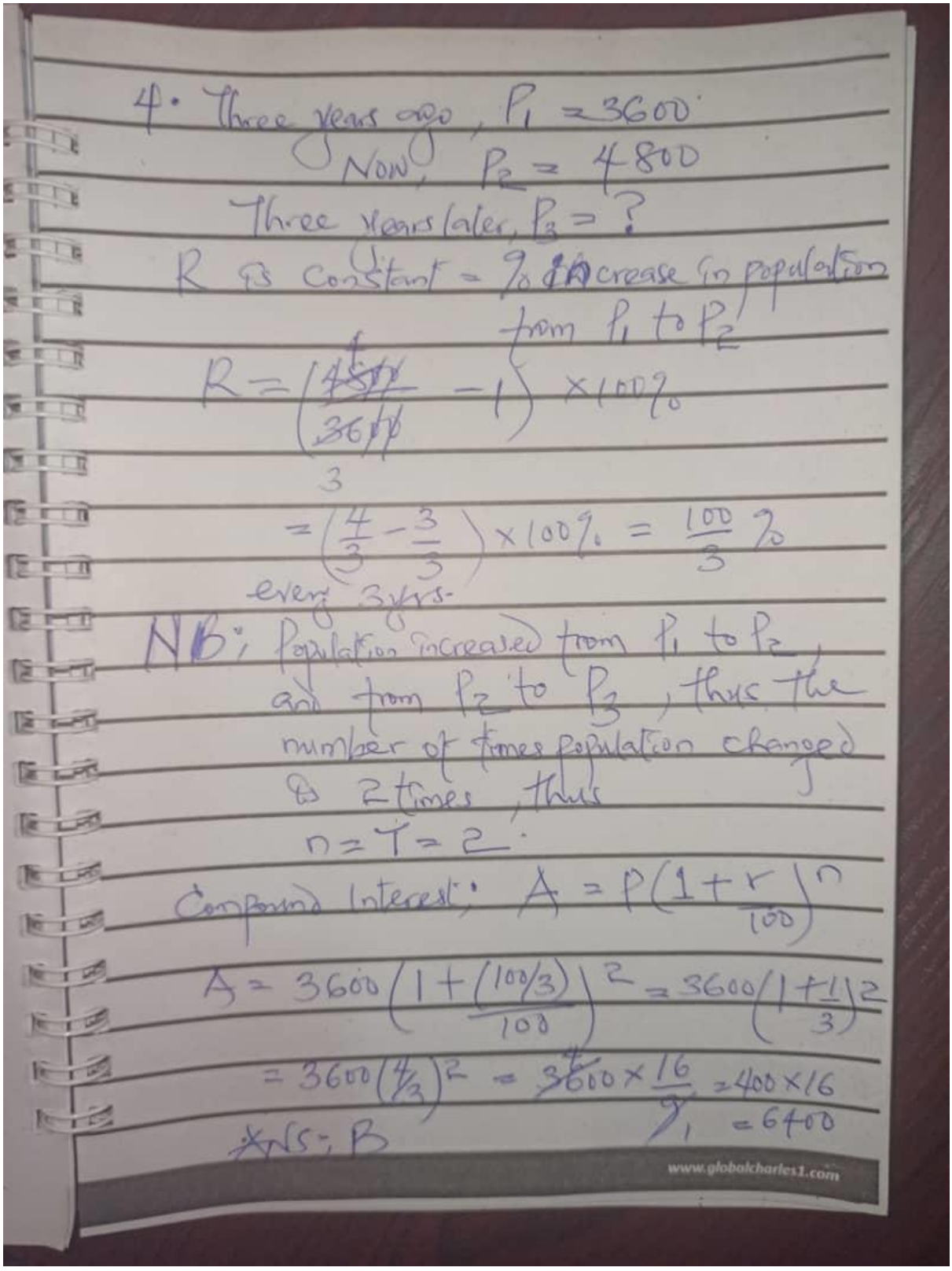
$\frac{r}{100} = \frac{12}{11} - \frac{11}{11} = \frac{1}{11}$

$r = \frac{100}{11}$.

$\frac{PRT}{100} = I$; $A = P + \frac{PRT}{100}$

$3x = x + \frac{x \times (100/11) \times T}{100}$; $3x - x = \frac{Tx}{11}$

$2x = \frac{Tx}{11}$; $T = 22$ yrs : Ans : B



4. Three years ago, $P_1 = 3600$
Now, $P_2 = 4800$
Three years later, $P_3 = ?$
R is constant = % increase in population from P_1 to P_2

$$R = \left(\frac{4800}{3600} - 1\right) \times 100\%$$

$$= \left(\frac{4}{3} - \frac{3}{3}\right) \times 100\% = \frac{100}{3}\%$$

every 3 yrs.

NB: Population increased from P_1 to P_2, and from P_2 to P_3, thus the number of times population changed is 2 times, thus

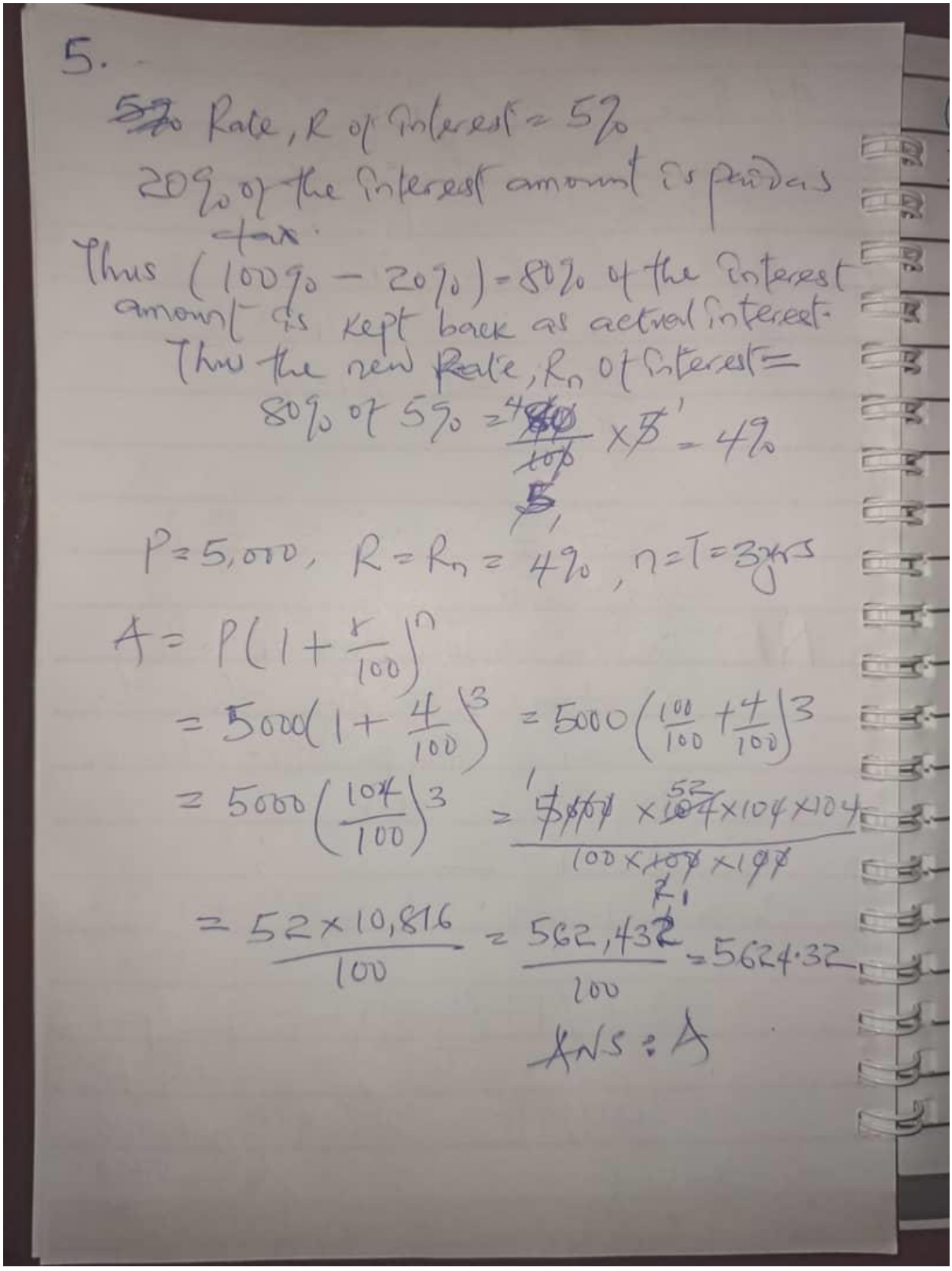
$n = T = 2$.

Compound Interest: $A = P\left(1 + \frac{r}{100}\right)^n$

$$A = 3600\left(1 + \frac{(100/3)}{100}\right)^2 = 3600\left(1 + \frac{1}{3}\right)^2$$

$$= 3600\left(\frac{4}{3}\right)^2 = \frac{3600 \times 16}{9_1} = 400 \times 16 = 6400$$

Ans: B



5.

Rate, R of Interest = 5%

20% of the interest amount is paid as tax.

Thus (100% − 20%) = 80% of the interest amount is kept back as actual interest.

Thus the new Rate, R_n of Interest =

$$80\% \text{ of } 5\% = \frac{4}{100} \times 5^{1} = 4\%$$

$P = 5{,}000$, $R = R_n = 4\%$, $n = T = 3\text{yrs}$

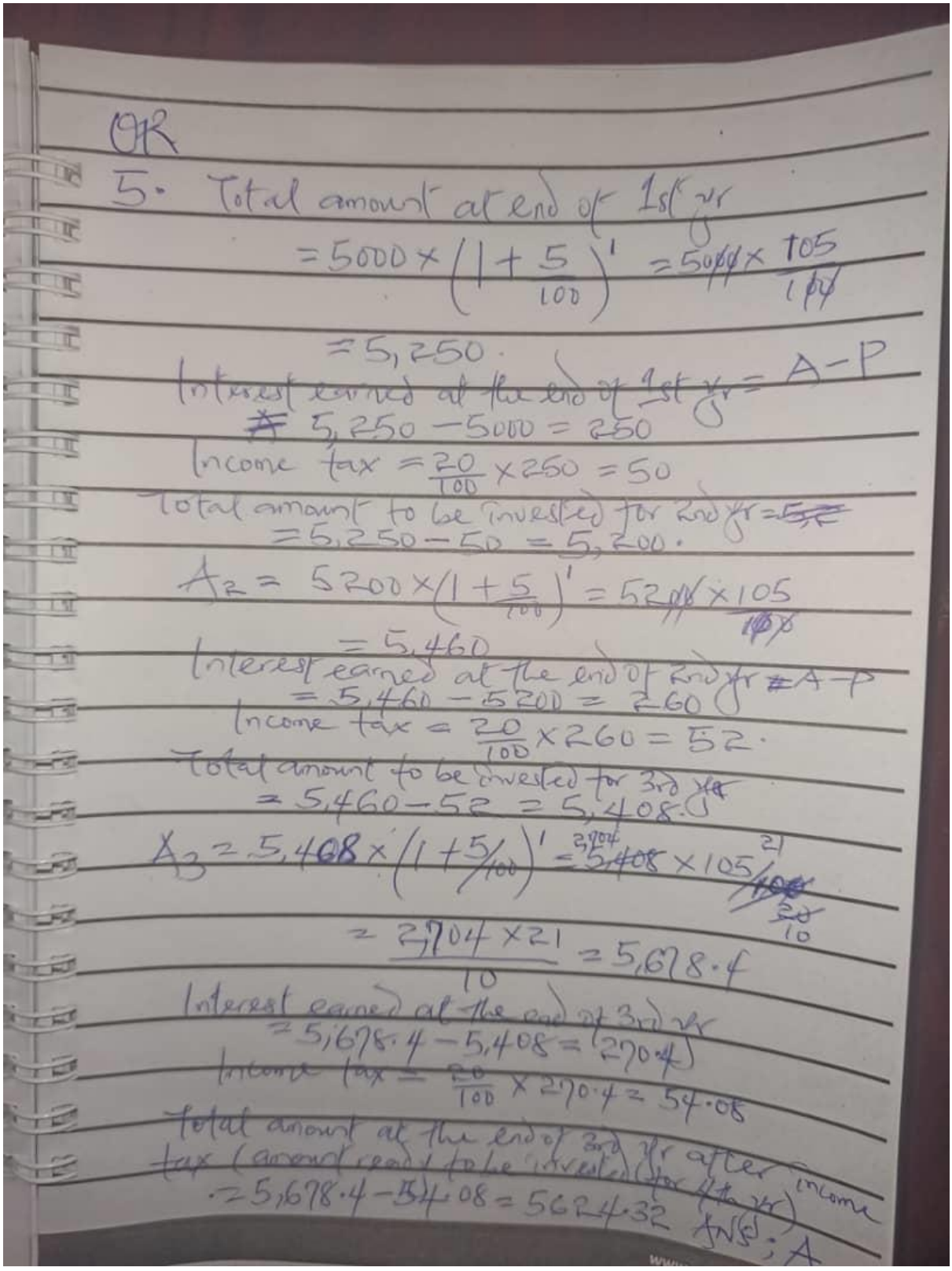
$$A = P\left(1 + \frac{r}{100}\right)^{n}$$

$$= 5000\left(1 + \frac{4}{100}\right)^{3} = 5000\left(\frac{100}{100} + \frac{4}{100}\right)^{3}$$

$$= 5000\left(\frac{104}{100}\right)^{3} = \frac{1}{5000} \times \frac{52}{104} \times 104 \times 104 \times 104 \;/\; 100 \times 100 \times 100$$

$$= \frac{52 \times 10{,}816}{100} = \frac{562{,}432}{100} = 5624.32$$

Ans: A



OR

5. Total amount at end of 1st yr

$= 5000 \times \left(1 + \frac{5}{100}\right)^1 = 5000 \times \frac{105}{100}$

$= 5,250.$

Interest earned at the end of 1st yr = A − P

$= 5,250 - 5000 = 250$

Income tax $= \frac{20}{100} \times 250 = 50$

Total amount to be invested for 2nd yr

$= 5,250 - 50 = 5,200.$

$A_2 = 5200 \times \left(1 + \frac{5}{100}\right)^1 = 5200 \times \frac{105}{100}$

$= 5,460$

Interest earned at the end of 2nd yr = A − P

$= 5,460 - 5200 = 260$

Income tax $= \frac{20}{100} \times 260 = 52.$

Total amount to be invested for 3rd yr

$= 5,460 - 52 = 5,408.$

$A_3 = 5,408 \times \left(1 + \frac{5}{100}\right)^1 = 5,408 \times \frac{105}{100}$

$= \frac{2704 \times 21}{10} = 5,678.4$

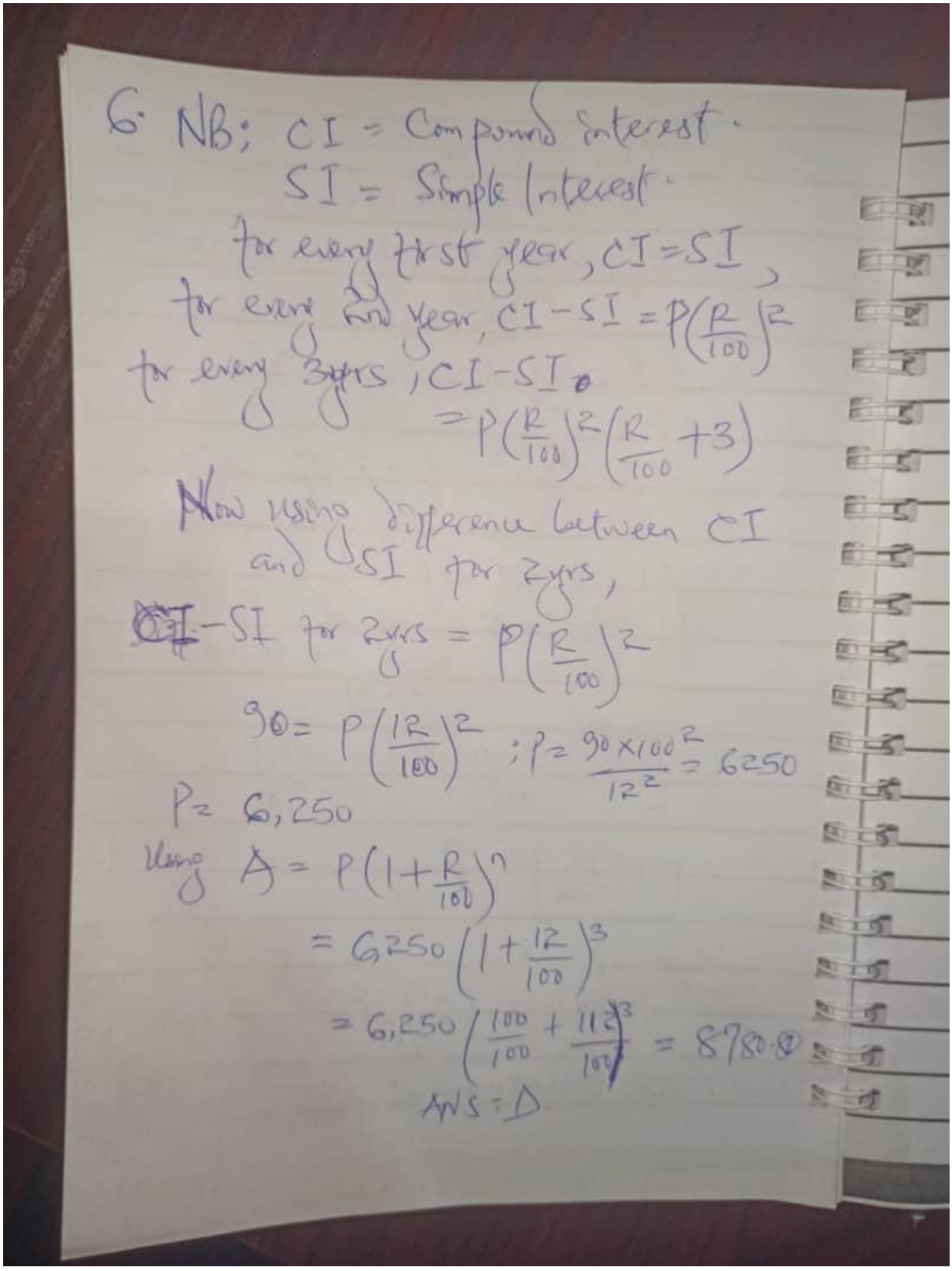
Interest earned at the end of 3rd yr

$= 5,678.4 - 5,408 = 270.4$

Income tax $= \frac{20}{100} \times 270.4 = 54.08$

Total amount at the end of 3rd yr after income tax (amount ready to be invested for 4th yr)

$= 5,678.4 - 54.08 = 5624.32$ Ans: A



6. NB; CI = Compound interest.
SI = Simple Interest.
for every first year, CI = SI,
for every 2nd year, $CI - SI = P\left(\frac{R}{100}\right)^2$
for every 3yrs, $CI - SI = P\left(\frac{R}{100}\right)^2\left(\frac{R}{100} + 3\right)$

Now using difference between CI and SI for 2yrs,

$CI - SI$ for 2yrs $= P\left(\frac{R}{100}\right)^2$

$90 = P\left(\frac{12}{100}\right)^2$; $P = \frac{90 \times 100^2}{12^2} = 6250$

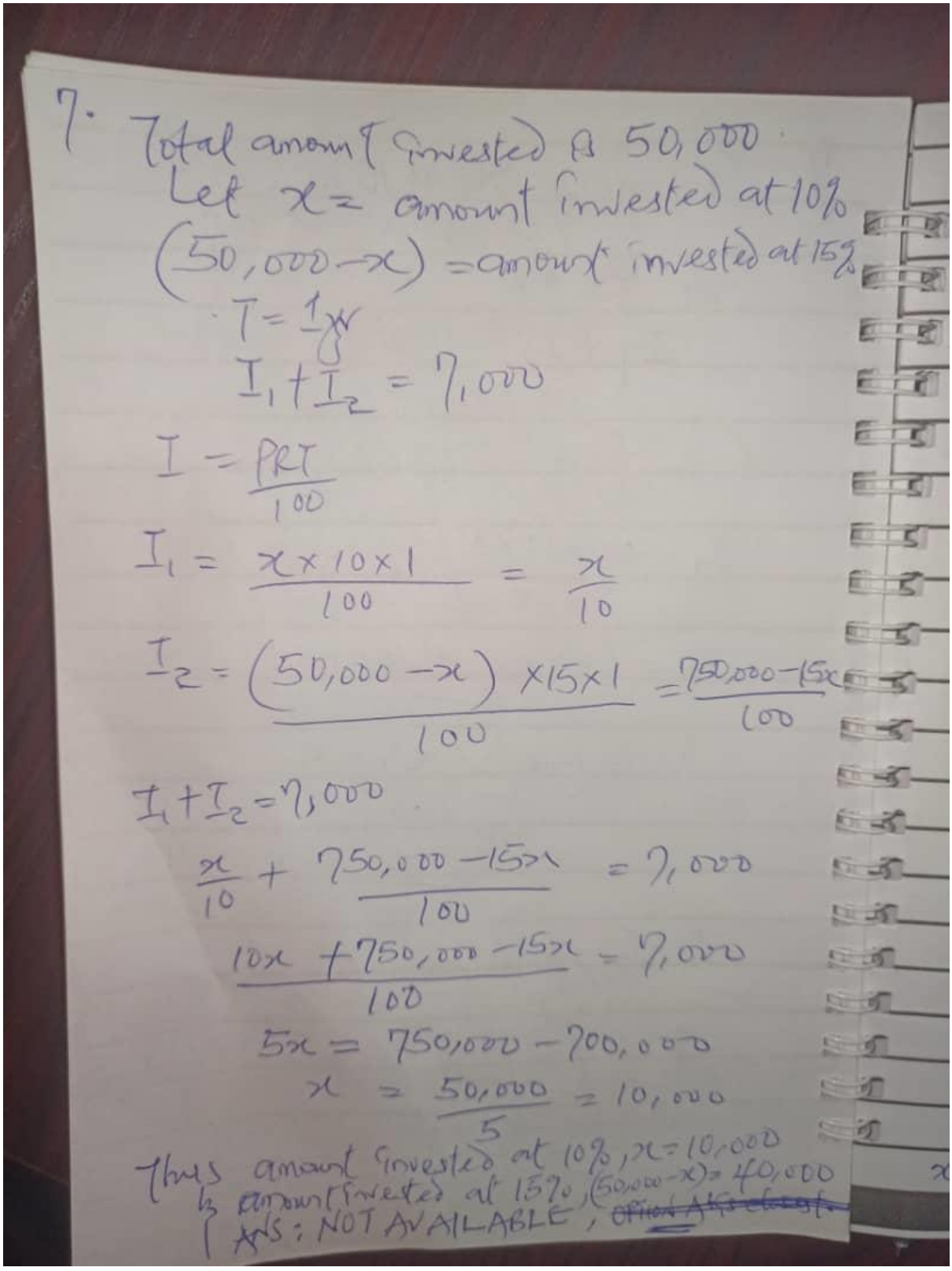
$P = 6,250$

Using $A = P\left(1 + \frac{R}{100}\right)^n$

$= 6250\left(1 + \frac{12}{100}\right)^3$

$= 6,250\left(\frac{100}{100} + \frac{112}{100}\right)^3 = 8780.8$

Ans: D



7. Total amount invested is 50,000
Let x = amount invested at 10%
$(50,000 - x)$ = amount invested at 15%

$T = I_1 + I_2$

$I_1 + I_2 = 7,000$

$I = \frac{PRT}{100}$

$I_1 = \frac{x \times 10 \times 1}{100} = \frac{x}{10}$

$I_2 = \frac{(50,000 - x) \times 15 \times 1}{100} = \frac{750,000 - 15x}{100}$

$I_1 + I_2 = 7,000$

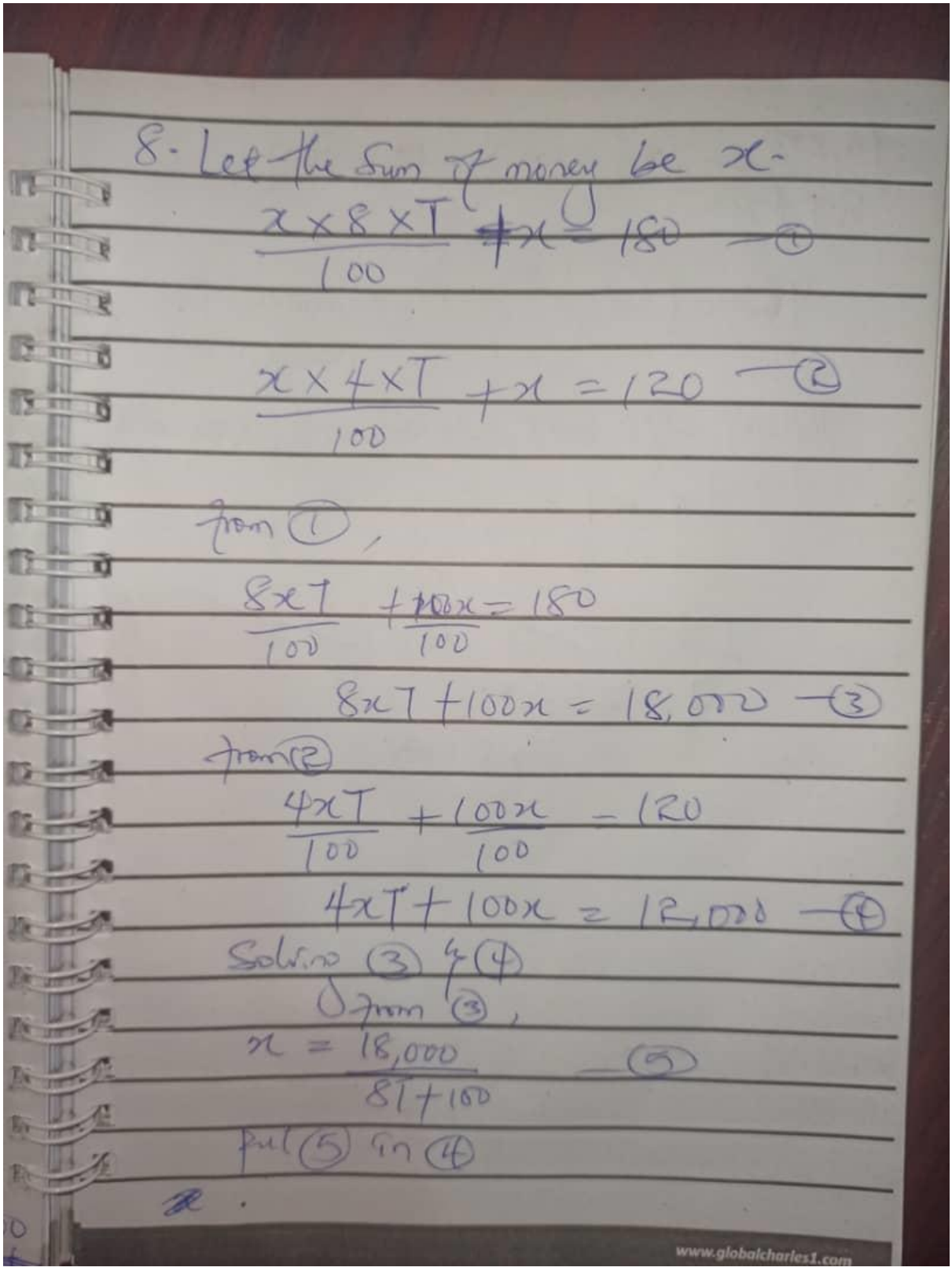
$\frac{x}{10} + \frac{750,000 - 15x}{100} = 7,000$

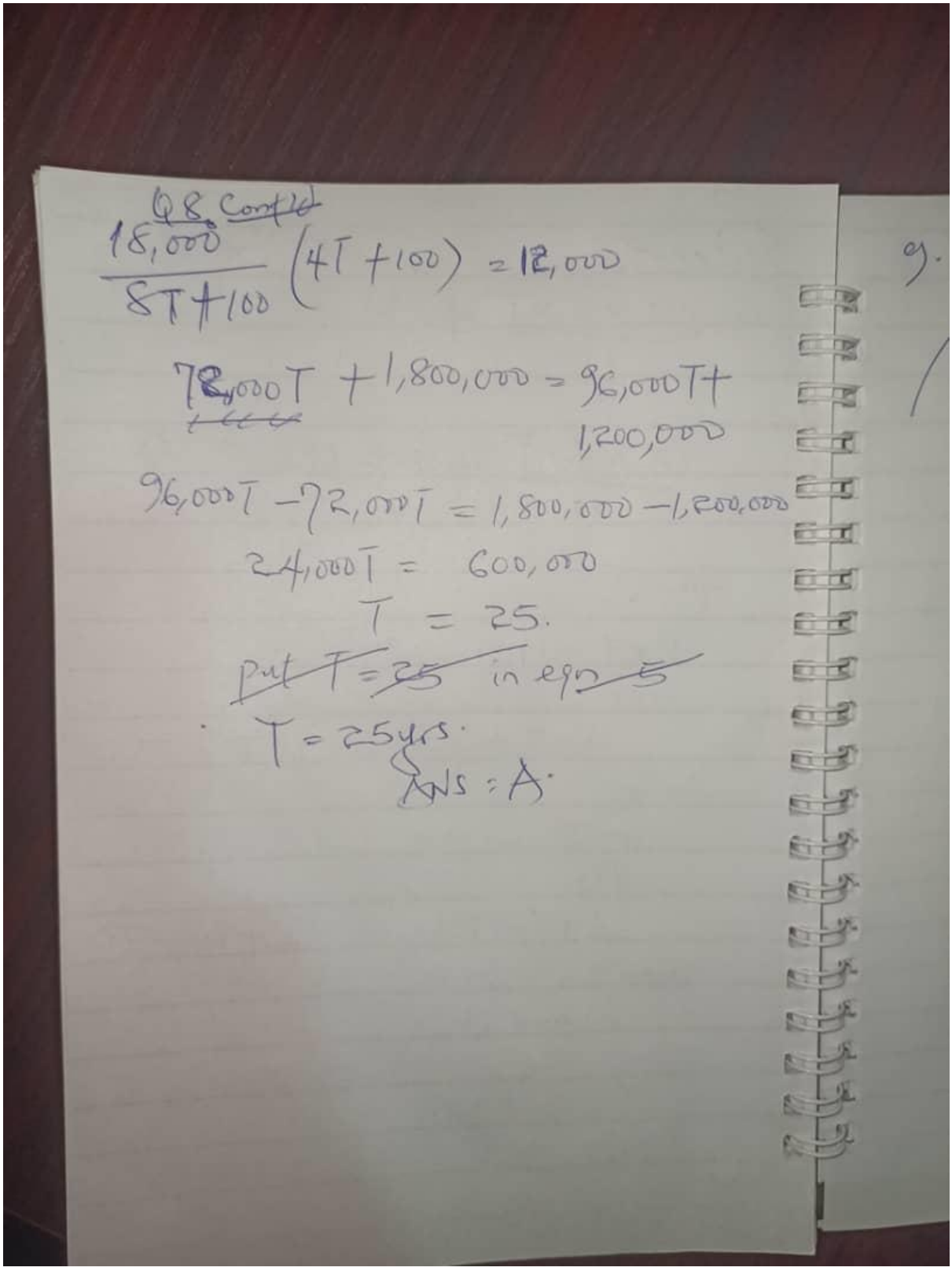
$\frac{10x + 750,000 - 15x}{100} = 7,000$

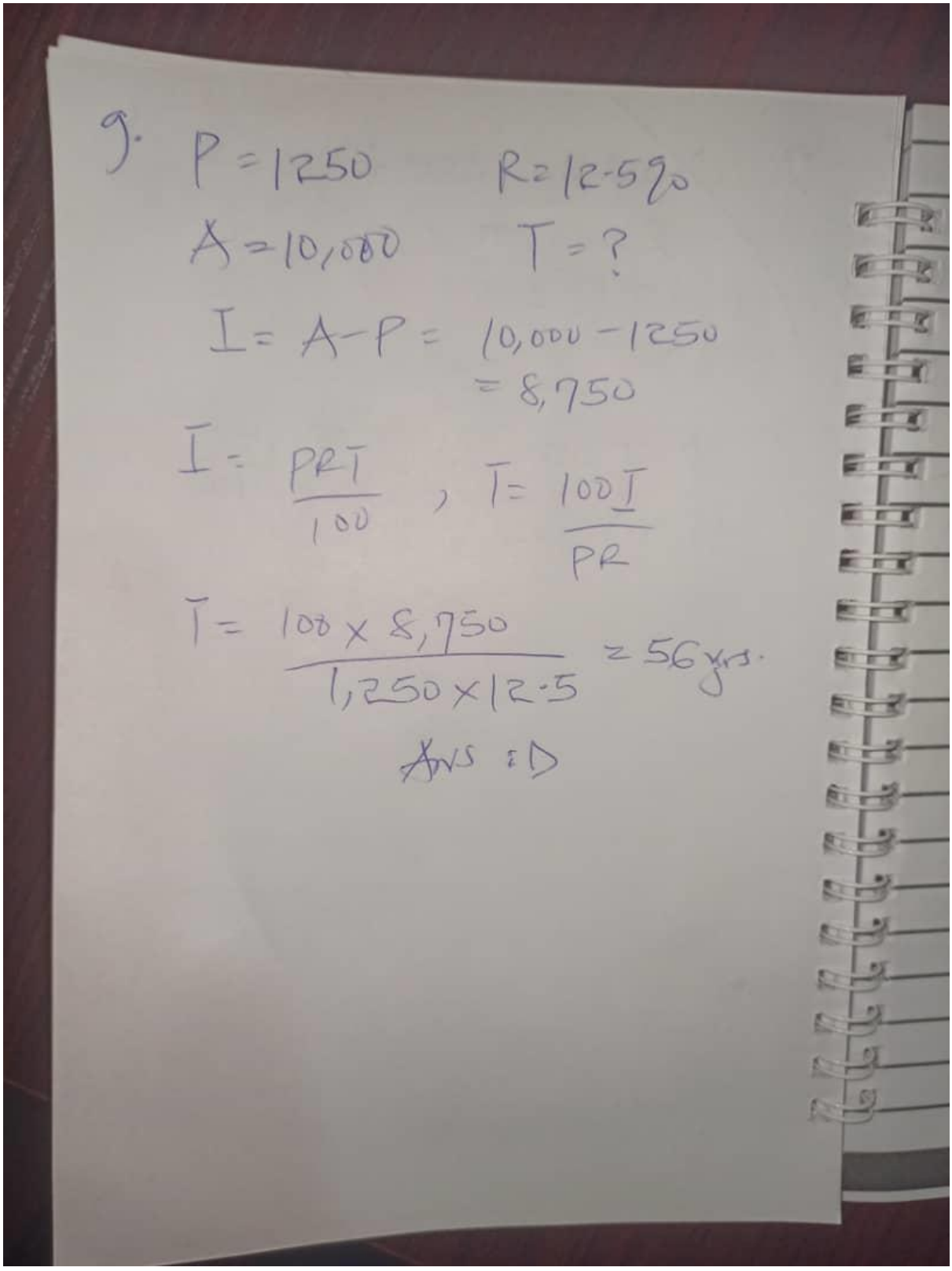
$5x = 750,000 - 700,000$

$x = \frac{50,000}{5} = 10,000$

Thus amount invested at 10%, $x = 10,000$
& amount invested at 15%, $(50,000 - x) = 40,000$
Ans: NOT AVAILABLE, ~~option A is correct~~


8. Let the sum of money be x.
$\frac{x \times 8 \times T}{100} + x = 180$ — ①
$\frac{x \times 4 \times T}{100} + x = 120$ — ②
from ①,
$\frac{8xT}{100} + \frac{100x}{100} = 180$
$8xT + 100x = 18,000$ — ③
from ②
$\frac{4xT}{100} + \frac{100x}{100} = 120$
$4xT + 100x = 12,000$ — ④
Solving ③ & ④
from ③,
$x = \frac{18,000}{8T + 100}$ — ⑤
put ⑤ in ④
www.globalcharles1.com


Q8 Contd
18,000 / 8T+100 (4T+100) = 12,000
72,000T + 1,800,000 = 96,000T + 1,200,000
96,000T − 72,000T = 1,800,000 − 1,200,000
24,000T = 600,000
T = 25.
Put T = 25 in eqn 5
T = 25yrs.
Ans: A.
9.


9. P = 1250 R = 12·5%
A = 10,000 T = ?
I = A − P = 10,000 − 1250
= 8,750
I = PRT / 100 , T = 100I / PR
T = 100 × 8,750 / 1,250 × 12·5 = 56 yrs.
Ans : D

10. Total amount = 5887

Shaym = S

Ramu = R, R = 5887 − S.

S = ?

$A = P\left(1+\frac{R}{100}\right)^n$

$S\left(1+\frac{5}{100}\right)^9 = (5887-S)\left(1+\frac{5}{100}\right)^{11}$

$\frac{S}{5887-S} = \frac{\left(\frac{21}{20}\right)^{11}}{\left(\frac{21}{20}\right)^9}$

By rules of indices,

$\frac{S}{5887-S} = \left(\frac{21}{20}\right)^2$

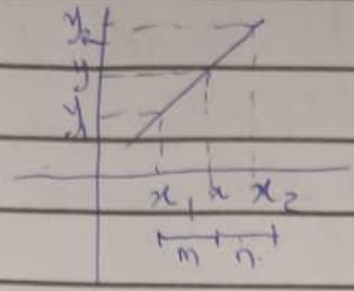
$\frac{S}{5887-S} = \frac{21}{20} \times \frac{21}{20}$

$400S = 21 \times 21\,(5887-S)$

$400S + 441x = 441 \times 5887$

$S = 3087$ Ans: C

11.



~~A(x)~~

$A(x_1, y_1)$ $B(x_2, y_2)$

Ratio $= m/n$ $P(x, y)$

Know this formula:

$$\Rightarrow P(x, y) = \frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}$$

$A(5, -2)$, $B(9, 6)$

$R = m/n = 1/3$

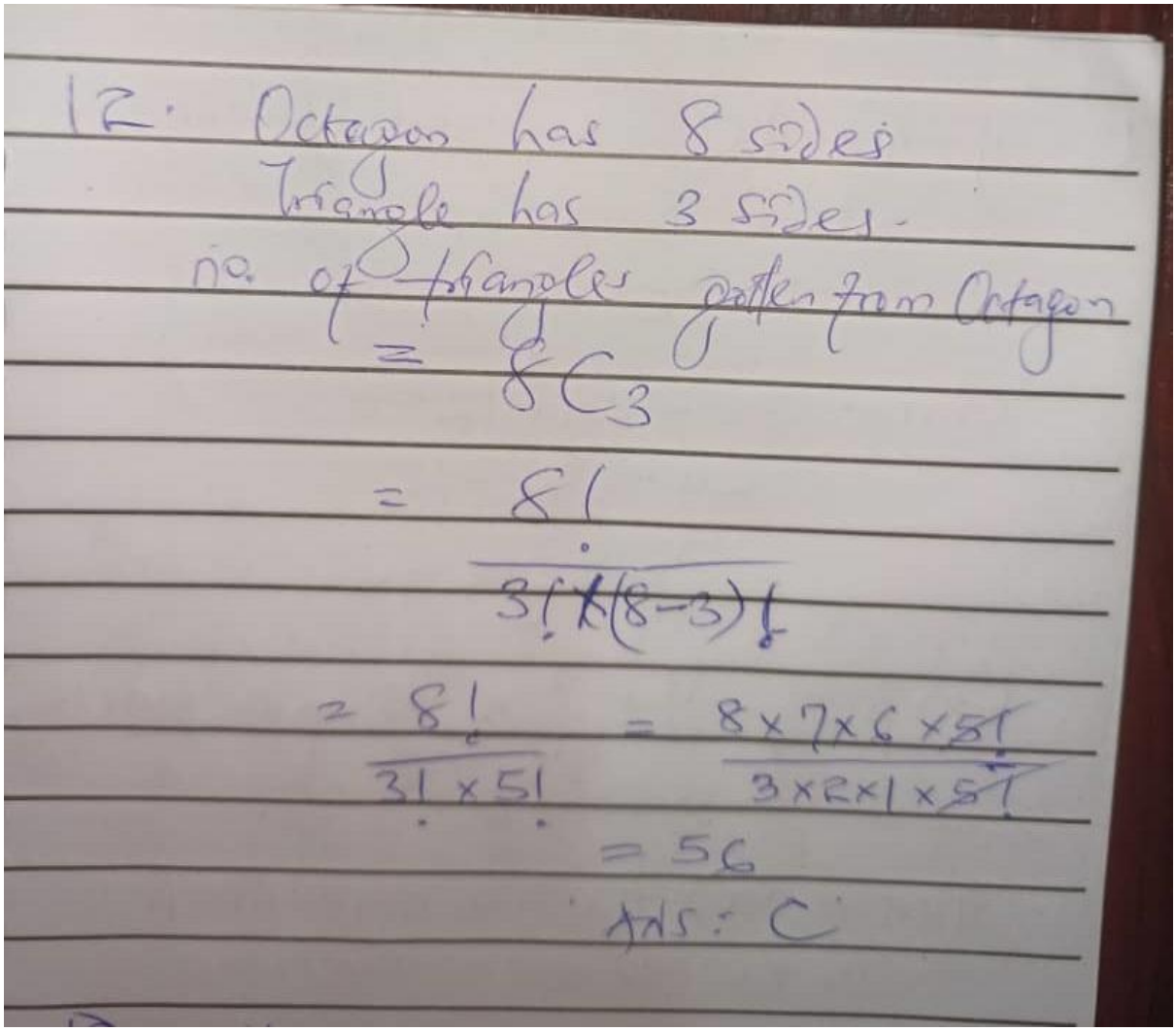
$$P(x, y) = \frac{1 \times 9 + 3 \times 5}{1+3}, \frac{1 \times 6 + 3 \times -2}{1+3}$$

$$= \frac{9+15}{4}, \frac{6-6}{4}$$

$$= \frac{24}{4}, \frac{0}{4}$$

$$= 6, 0$$

Ans: A.


12. Octagon has 8 sides
Triangle has 3 sides.
no. of triangles gotten from Octagon
= 8C3
= 8!/3!×(8-3)!
= 8!/3!×5! = 8×7×6×5!/3×2×1×5!
= 56
Ans: C

13. $y = mx + c$ — eqn of line

where m = slope

c = y-intercept.

Given: $3x - 2y - 12 = 0$

$2y = 3x - 12$

$y = \frac{3}{2}x - 6$

Comparing $y = \frac{3}{2}x - 6$ with $y = mx + c$,

$c = -6$

question said the line eqn in view has twice the intercept of the former.

thus $c_2 = -6 \times 2 = -12$

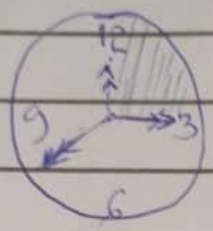
New line eqn has same parameters as the former except for the intercept that is twice that of the former.

New line eqn: $y = \frac{3}{2}x - 12$.

$\Rightarrow 2y = 3x - 24$

ANS: A. $3x - 2y = 24$

14.



The hour hand moved through 3hrs, say from 0:00hrs to 3:00hrs.

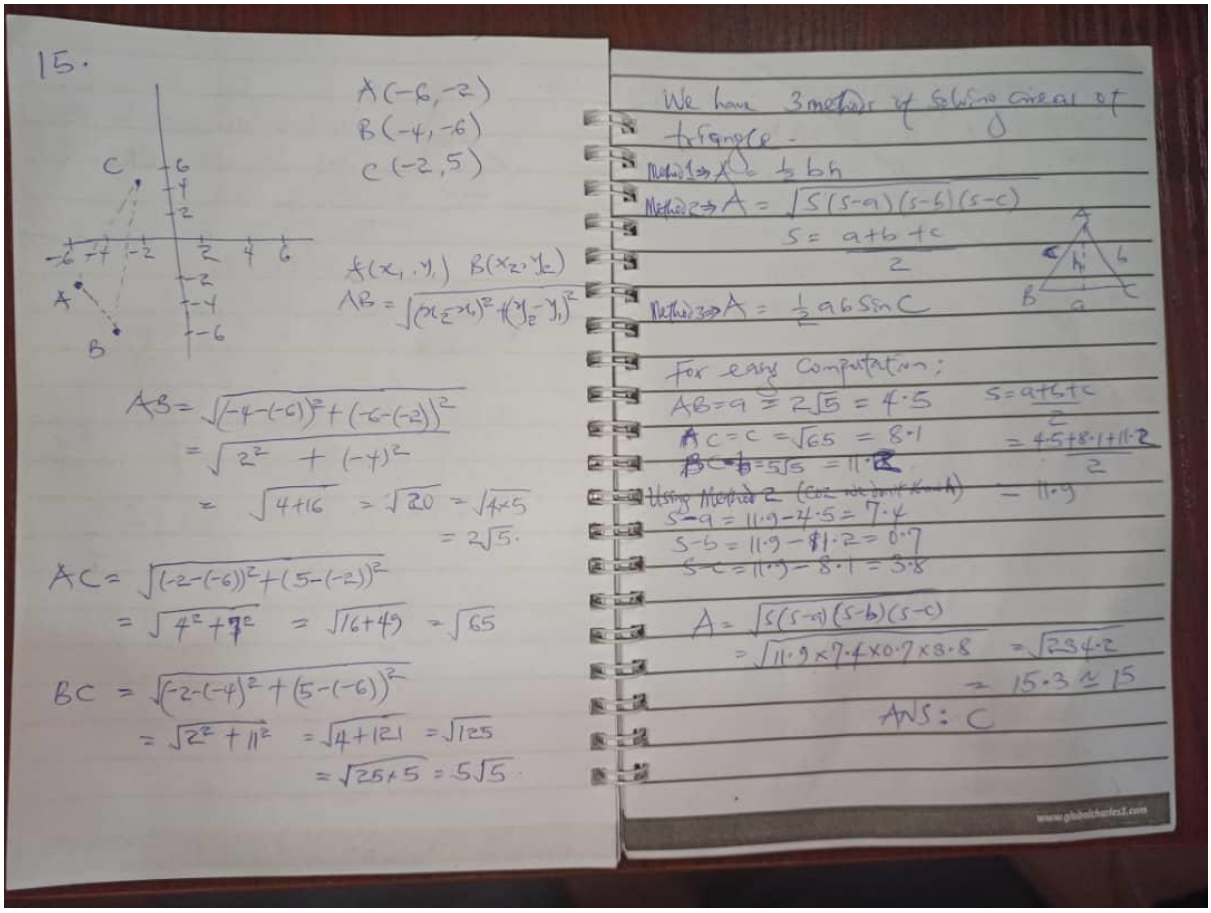
Thus, it covered $\frac{1}{4}$ of a complete circle.

Area of Circle $= \pi R^2$

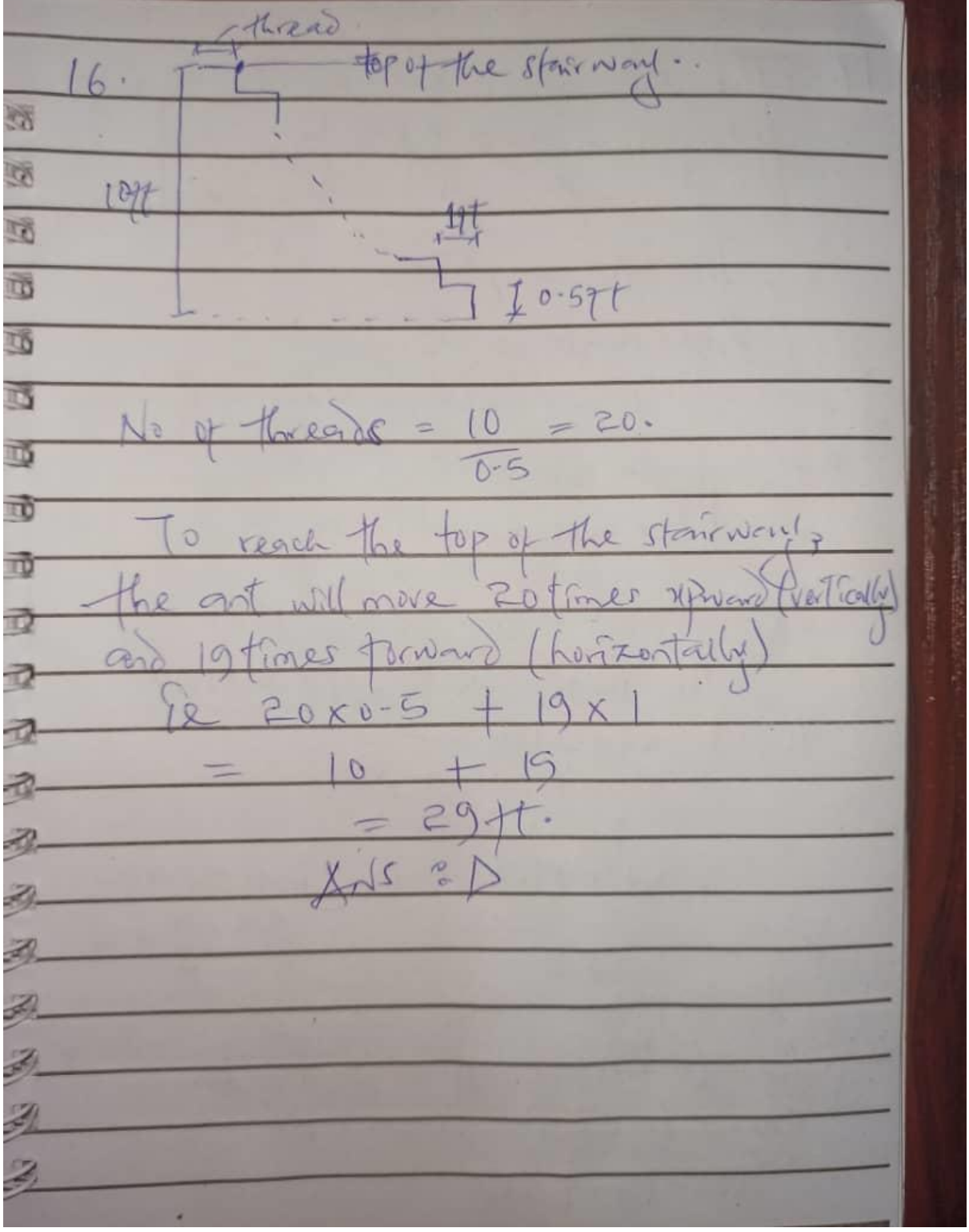
Area covered $= \frac{\pi R^2}{4} = \frac{\pi \times 7^2}{4}$

$= \frac{22}{7} \times \frac{7 \times 7}{4} = \frac{77}{2} = 38.5$ Sq.cm

Ans : B


15.
A(-6,-2)
B(-4,-6)
C(-2,5)
C
A
B
AB = √(-4-(-6))² + (-6-(-2))²
= √2² + (-4)²
= √4+16 = √20 = √4×5
= 2√5
AC = √(-2-(-6))² + (5-(-2))²
= √4² + 7² = √16+49 = √65
BC = √(-2-(-4))² + (5-(-6))²
= √2² + 11² = √4+121 = √125
= √25×5 = 5√5
We have 3 methods of finding area of triangle.
Method 1 ⇒ A = ½ bh
Method 2 ⇒ A = √s(s-a)(s-b)(s-c)
s = a+b+c / 2
Method 3 ⇒ A = ½ ab sin C
For easy computation:
AB = a ≈ 2√5 = 4.5
AC = c = √65 = 8.1
BC = b = 5√5 = 11.2
s = 11.9
s-a = 11.9 - 4.5 = 7.4
s-b = 11.9 - 11.2 = 0.7
s-c = 11.9 - 8.1 = 3.8
A = √s(s-a)(s-b)(s-c)
= √11.9×7.4×0.7×3.8 = √234.2
≈ 15.3 ≈ 15
s = a+b+c / 2 = 4.5+8.1+11.2 / 2 = 11.9
Ans: C

16.



No of threads $= \frac{10}{0.5} = 20.$

To reach the top of the stairway, the ant will move 20 times upward (vertically) and 19 times forward (horizontally)

i.e $20 \times 0.5 + 19 \times 1$

$= 10 + 19$

$= 29ft.$

Ans : D

17. The sum of interior angles of any Polygon = $(n-2)$ triangles OR $=(2n-4)$ right angles.

Triangle $= 180°$

Right angle $= 90°$

n = number of sides of the polygon.

The question said:

let exterior angle $= x$

Interior angle $= y$

at any given time, $x+y=180$.

The question said: $y = x+120$

Thus; $x+y=180$ — ①

$y = x+120$ — ②

put ① in ②

$x+x+120=180$; $2x=180-120$

$x = \frac{60}{2} = 30$

Put $x=30$ in ②

$y = 30+120 = 150$.

Using: $n\theta = (n-2)180$; where $\theta = y$.

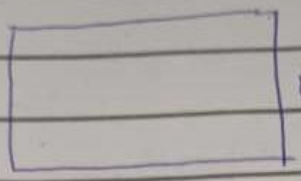
$150n = (n-2)180$; $150n = 180n - 360$

$180n - 150n = 360$; $30n = 360$

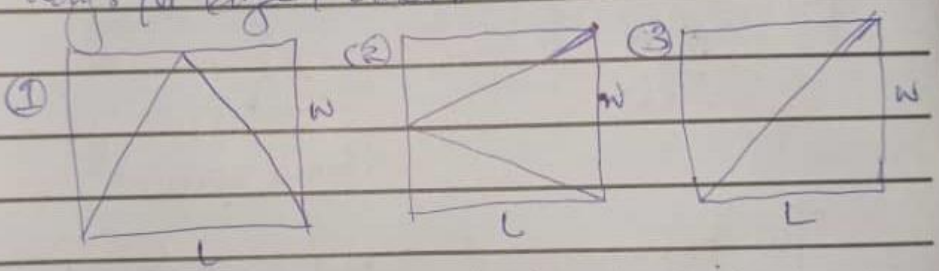
$n = \frac{360}{30} = 12$

ANS: C

18.



You can fit in triangles in the following ways for largest area:



Now L = 2 & W = 1

Case 1: $A = 2 \times 1/2 = 1$.

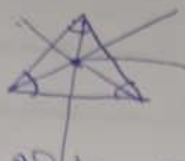
Case 2: $A = \frac{1}{2} \times 1 \times 2 = 1$

Case 3: $A = \frac{1}{2} \times 1 \times 2 = 1$.

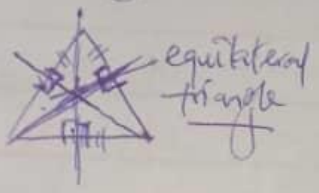
Thus all three cases have same areas of triangles.

$\frac{1}{2}bh = (LW)/2$. Ans: D

19.

A.  incentre.

The point at which the three angle bisectors meet is the incentre. (And it is also the centre of any inscribed circle to this triangle). CORRECT.

B. 

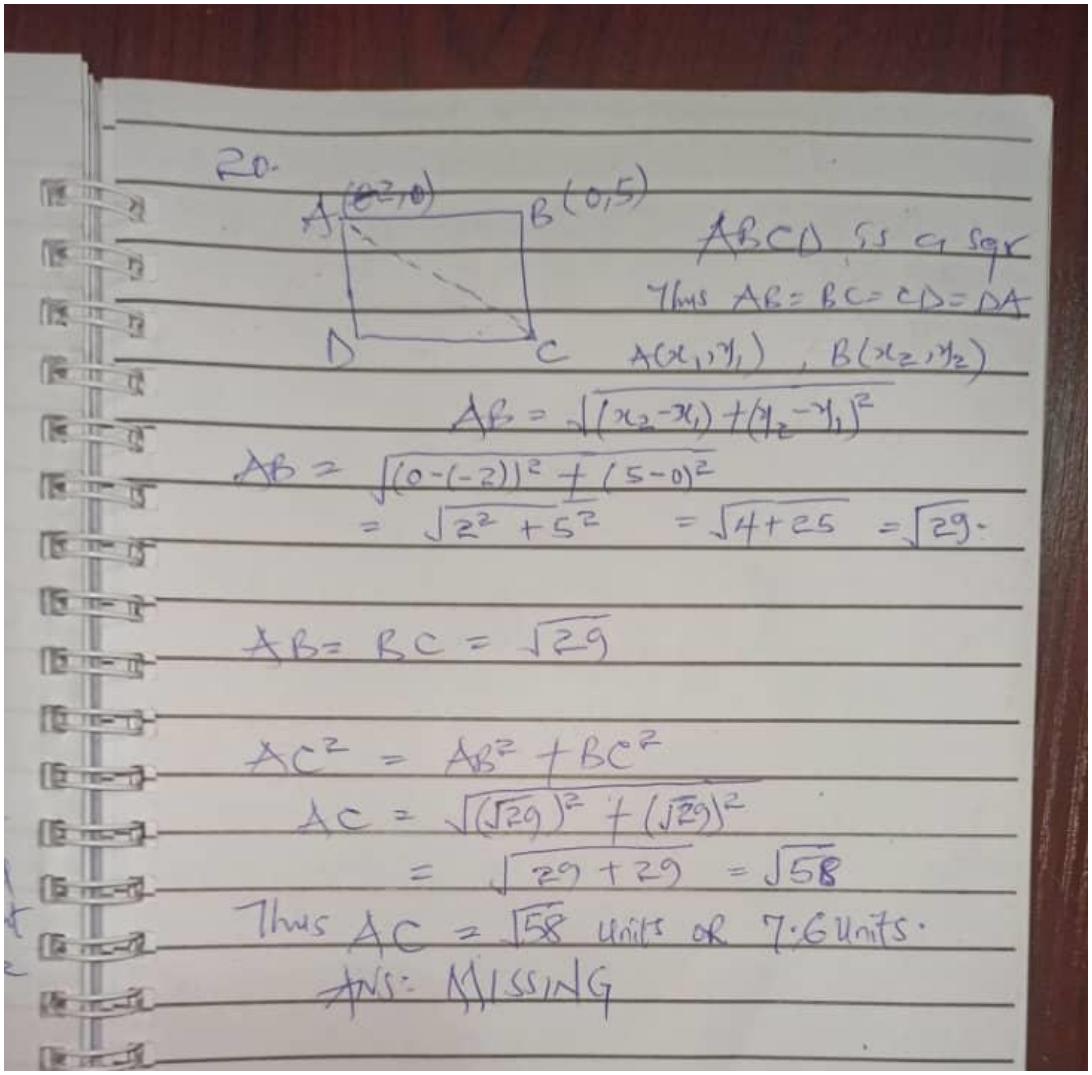
The median of a triangle bisects the line of a side, but it need not necessarily bisect it at right angles. All 3 medians of an equilateral triangle and the median to the side that is not equal on an isosceles triangle meet the side at right angles.

So the stated option is INCORRECT.

C. The 3 altitudes of a triangle meet concurrently at a point and that point is known as orthocentre. (Altitude is a line which passes through a vertex of a triangle and is perpendicular to the opposite side). CORRECT.

D. The 3 perpendicular bisectors of a triangle meet concurrently at a point called circumcentre. CORRECT.

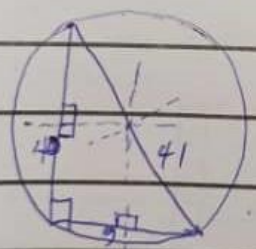
Ans: B


20.
A
B (0,5)
D
C
ABCD is a Sqr
Thus AB = BC = CD = DA
A(x1, y1) , B(x2, y2)
AB = √((x2 − x1) + (y2 − y1)²
AB = √((0 − (−2))² + (5 − 0)²
= √(2² + 5²) = √(4 + 25) = √29.
AB = BC = √29
AC² = AB² + BC²
AC = √((√29)² + (√29)²
= √(29 + 29) = √58
Thus AC = √58 units or 7.6 units.
Ans: MISSING

PART 4

Numericals 4th Set.

1.



(It is a right angle triangle
coz $40^2 + 9^2 = 41^2$)

For a circle circumscribed on a right-angled triangle, the hypotenuse is the diameter.

Thus hypotenuse = 41. = Diameter

Therefore the circum radius = $\frac{41}{2} = 20.5$

ANS : D.

2. $n\theta = (n-2)\,180$ where n = number of sides, θ = each interior angle.

If: $n\theta = 1440$

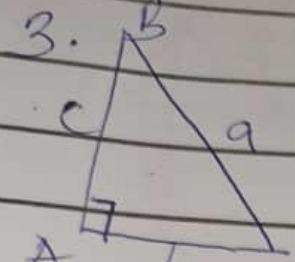
$1440 = (n-2)\,180$

$n - 2 = \frac{1440}{180} = 8.$

$n = 8 + 2 = 10$ sides.

ANS : A.

3.



from Heron's formula for Area;

$A = \sqrt{s(s-a)(s-b)(s-c)}$

$s = \frac{a+b+c}{2}$

$a > b > c$

Let $a = 5$, $b = 4$ & $c = 3$.

(because these are the 3 smallest integers that satisfies pythagorean triplet)

$s = \frac{a+b+c}{2} = \frac{5+4+3}{2} = \frac{12}{2} = 6.$

Substituting these values in the options to check.

A. $(s-b)(s-c) > s(s-a)$

$(6-4)(6-3) = 2 \times 3 = 6$ — LHS

$6(6-5) = 6 \times 1 = 6$ — RHS

LHS = RHS INCORRECT

B. $(s-a)(s-c) > s(s-b)$

LHS $\Rightarrow (6-5)(6-3) = 1 \times 3 = 3$

RHS $\Rightarrow 6(6-4) = 6 \times 2 = 12$

LHS < RHS INCORRECT.

C. $(s-a)(s-b) < s(s-c)$

LHS $\Rightarrow (6-5)(6-4) = 1 \times 4 = 4$

RHS $\Rightarrow 6(6-3) = 6 \times 3 = 18$

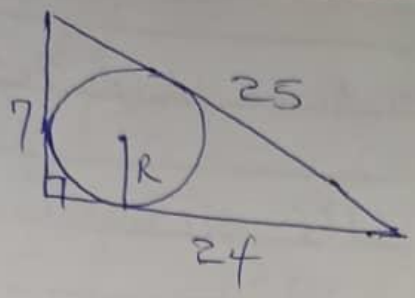
LHS < RHS CORRECT.

D. $4S(s-a)(s-b)(s-c) = bc$; RHS $= 5 \times 4 = 20$

LHS $\Rightarrow 4 \times 6 \times (6-5)(6-4) = 4 \times 6 \times 1 \times 2 = 48$. ; LHS > RHS INCORRECT

ANS: B

4.



(It is a ∟ coz $7^2+24^2=25^2$).

for a circle inscribed in a right-angled triangle,

Area of triangle = $\frac{\text{Perimeter} \times \text{Radius}}{2}$

from $A = \sqrt{s(s-a)(s-b)(s-c)}$,

$s = \frac{a+b+c}{2} = \frac{\text{Perimeter}}{2}$.

Area of triangle = $\frac{1}{2} \times 24 \times 7 = 84$.

$s = \frac{24+7+25}{2} = 28$.

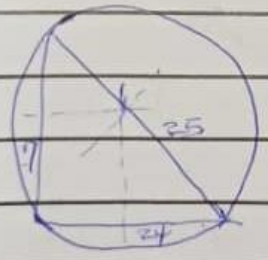
$\therefore 84 = 28 \times R$.

$R = \frac{84}{28} = 3$.

Alternatively:
for inscribed circle in a right angled triangle,
$r = s - h$
r = radius, s = semi perimeter, h = hypotenuse.
$r = 28 - 25 = 3$.

Ans B

5.



(it is a right angled triangle coz $7^2+24^2=25^2$)

for a circle circumscribed on a right-angled triangle, the hypotenuse is the diameter.

Thus $H = 25 = D$

$\therefore R = D/2 = 25/2 = 12.5$

ANS : B.

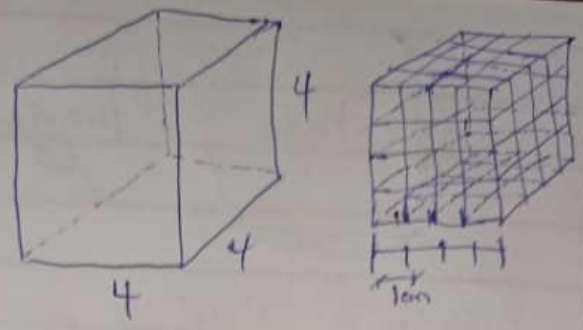
6.

When hexagon is inscribed in a circle, it forms equilateral triangles whose sides = r.

Thus perimeter of hexagon $= 6 \times r = 6r$

Ans : B.

Q. 4cm



8.

Volume of 4cm³ cube = 4×4×4 = 64cm³

If it is cut into 1cm cube, the volume of each of the 1cm cube = 1×1×1 = 1cm³.

x nos of 1cm³ will give the total volume of the 4cm³ cube = 64cm³
(volume is constant).

Thus, x × 1cm³ = 64cm³

x nos of 1cm³ cube = $\frac{64}{1}$ = 64 nos.

A cube has 6 sides.

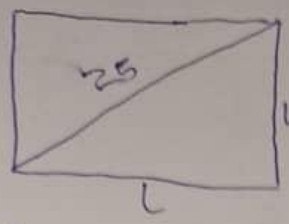
Surface area of 4cm cube = (4×4)×6
= 16×6 = 96cm²

Surface area of 1cm cube = 64 × (1×1) × 6
= 64 × 1 × 6 = 384cm²

% change = $\left(\frac{\text{New}}{\text{old}} - 1\right) \times 100\%$ = $\left(\frac{384}{96} - 1\right) \times 100\%$

= (4−1) × 100% = 3 × 100% = 300% ANS: B

8.



Given, Area = $168m^2$

$WL = 168m^2$ — ①

$(W)^2 = 25^2$ — ②

You remember addition of two squares?

$x^2+y^2 = (x+y)^2 - 2xy$

$x^2+y^2 = (x-y)^2 + 2xy$

Proof of formula:

① $(x+y)^2 = (x+y)(x+y) = x^2+xy+xy+y^2 = x^2+2xy+y^2$

$x^2+y^2 = (x+y)^2 - 2xy.$

② $(x-y)^2 = (x-y)(x-y) = x^2-xy-xy+y^2 = x^2-2xy+y^2$

$x^2+y^2 = (x-y)^2 + 2xy.$

thus;

$L^2+W^2 = (L+W)^2 - 2WL$ — ③

$L^2+W^2 = (L+W)^2 + 2WL$ — ④

Substituting eqns ① & ② in ③ & ④,

$25^2 = (L+W)^2 - 2\times168$

$(L+W)^2 = 625+336 = 961$; $L+W = \sqrt{961} = 31$

$L+W = 31$ — ⑤

$25^2 = (L-W)^2 + 2\times168$

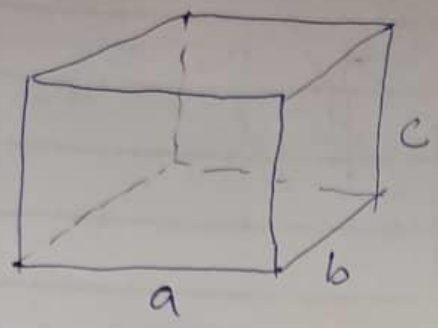
$(L-W)^2 = 625-336 = 289$; $L-W = \sqrt{289} = 17$

$L-W = 17$ — ⑥

Solving eqns ⑤ & ⑥,

$2L = 31+17 = 48$; $L = \frac{48}{2} = 24m$ ANS: D

9.



from the question, ~~ab = 6~~

$ab = 6$

$ac = 15$

$bc = 10$.

Required = volume = $a \times b \times c = ?$

$ab \times ac \times bc = 6 \times 15 \times 10$

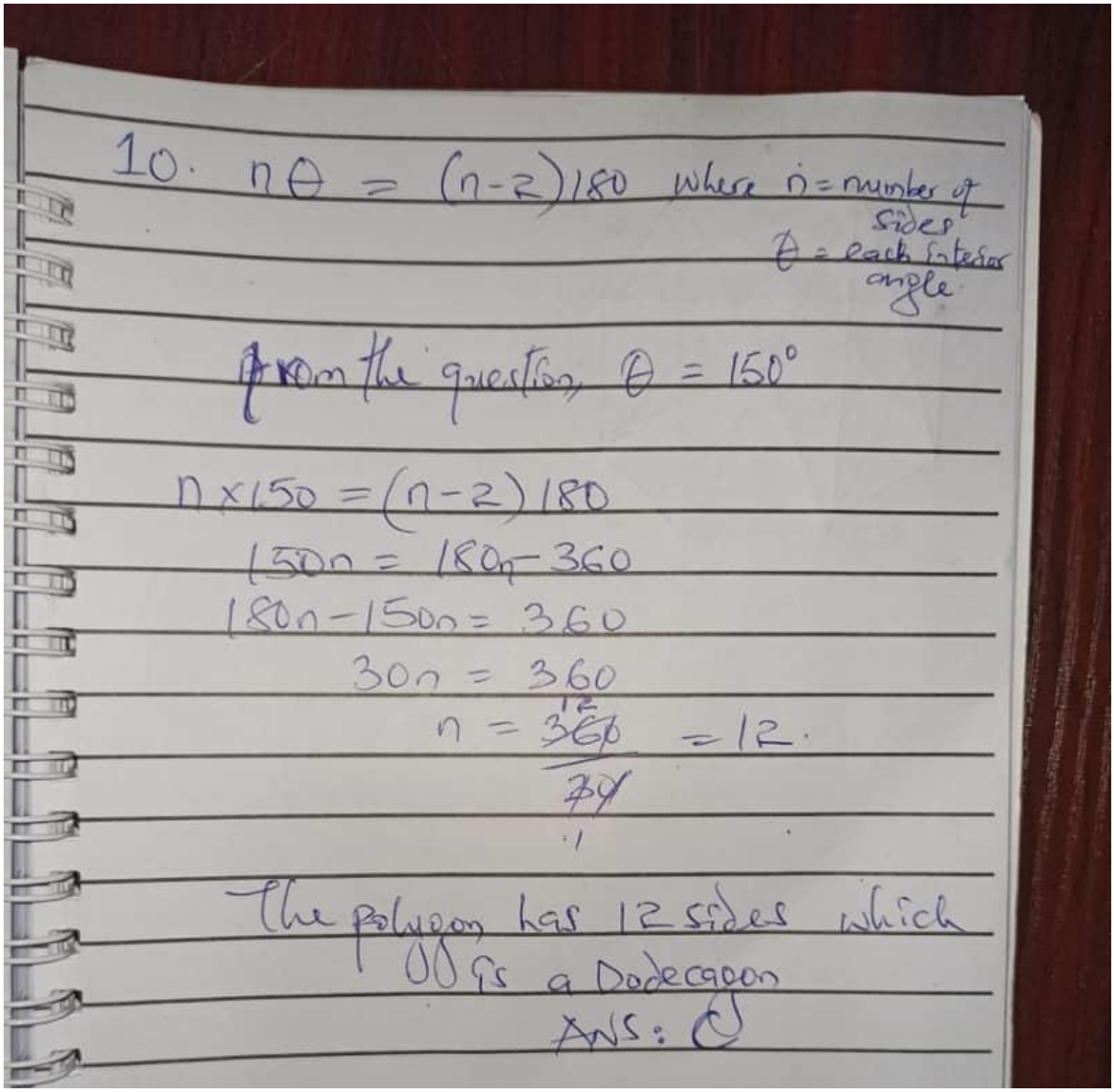
$a^2b^2c^2 = 900$

square root of both sides.

$\sqrt{a^2b^2c^2} = \sqrt{900}$

$abc = 30\ cm^3$.

ANS: A.



10. $n\theta = (n-2)180$ where n = number of sides, θ = each interior angle

From the question, $\theta = 150°$

$n \times 150 = (n-2)180$

$150n = 180n - 360$

$180n - 150n = 360$

$30n = 360$

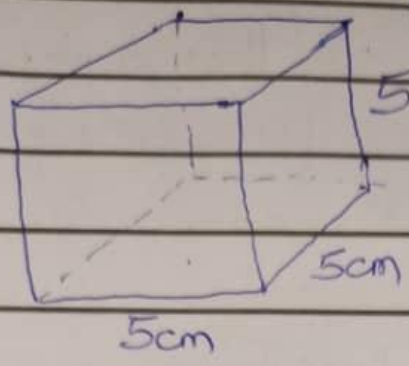
$n = \frac{360}{30} = 12$.

The polygon has 12 sides which is a Dodecagon

Ans: C

Num 4th set Cont'd

11.



Volume of 5cm cube = $5 \times 5 \times 5 = 125cm^3$

Volume of 1cm cube = $1 \times 1 \times 1 = 1cm^3$.

$\therefore$ nos of $1cm^3 = 125cm^3$.

$\therefore$ nos of $1cm^3 = \frac{125cm^3}{1cm^3} = 125$ nos.

A cube has 6 sides.

Surface area of $5cm^3$ cube $= 5 \times 5 = 25cm^2$

Surface area of the 6 sides $= 25 \times 6 = 150 cm^2$

Total Surface area of $1cm^3$ cube $= (1 \times 1) \times 125 \times 6$

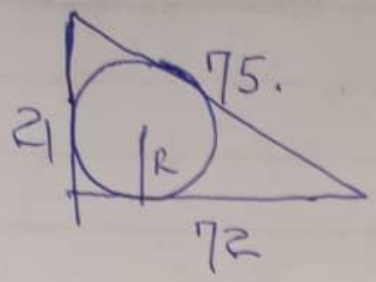
$= 750cm^2$.

Ratio $\Rightarrow$ $150cm^2 : 750cm^2$

$= 1 : 5$

Ans : B.

12.



(It is a right-angled triangle coz $21^2+72^2=75^2$)

For a circle inscribed in a right-angled triangle, Area of triangle = Semi-perimeter × Radius

(Where Semi-perimeter, $S=\frac{P}{2}$)

P = perimeter.

$$S=\frac{a+b+c}{2}=\frac{21+72+75}{2}=84.$$

Area of triangle $=\frac{1}{2}bh=\frac{1}{2}\times 72\times 21=756.$

For inscribed circle, $A=S\times R$.

$$756=84\times R;\ R=\frac{756}{84}=9.$$

Thus In-Radius = 9.

ANS: C.

Alternatively: For inscribed circle in a right-angled triangle, $R=S-H$

R = Radius, S = Semi-perimeter

H = Hypotenuse.

$R=S-H;\ R=84-75=9.$

ANS: C.

13. Circumference of front wheel = 30ft.
Circumference of back wheel = 36ft.
Let n = no of revolutions made by back wheel
& d = distance covered.

The question said, when the back wheel makes n revolutions, the front wheel makes (n+5) revolutions.

Since the both wheels covered same distance,

$n \times 36 = (n+5) \times 30$.

$36n = 30n + 150$

$6n = 150 \; ; \; n = 25$.

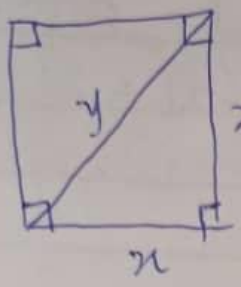
Distance Covered = number of revolutions × Circumference.

$= 25 \times 36 = 900$ ft.

(and is also $(n+5) \times 30 = (25+5) \times 30 = 900$ ft)

Ans : D.

14.



$x \times x = 24,200\ m^2$.

$x^2 = 24,200$

$x = \sqrt{24,200}$

(Coz you are not solving with Calculator)

$x = \sqrt{4 \times 25 \times 121 \times 2}$

$= 2 \times 5 \times 11\sqrt{2}$

$= 110\sqrt{2}$

$y = \sqrt{x^2 + x^2}$

$y = \sqrt{2x^2} = \sqrt{2 \times (110\sqrt{2})^2}$

$= \sqrt{2 \times 110 \times 110 \times 2}$

$= 2 \times 110 = 220\ m$.

Given: Rate = speed = 6.6 Km/hr.

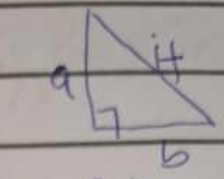
Speed = $\frac{\text{distance}}{\text{time}}$; time = $\frac{\text{distance}}{\text{speed}}$.

NB: the speed is in Km/hr. & our distance is in meters, thus change 220m to Km = 0.22 Km.

time = $\frac{0.22}{6.6} = \frac{22}{660} = \frac{1}{30}$ hrs = $\frac{60}{30}$ mins.

$= 2$ mins ANS: B.

15. $H^2 = a^2 + b^2$



Know your Squares of the Integers from 1 to 15 :

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 & 15

$= 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225$

A. $13 = 4 + 9 = 2^2 + 3^2$; $H^2 = a^2 + b^2$ CORRECT.

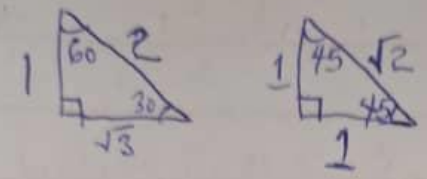
B. 23 cannot be expressed as $a^2 + b^2$ INCORRECT

C. $37 = 1 + 36 = 1^2 + 6^2$; $H^2 = a^2 + b^2$ CORRECT.

D. $41 = 16 + 25 = 4^2 + 5^2$; $H^2 = a^2 + b^2$ CORRECT.

Thus ANS: B.

16. Please Know your common angles' sines, cosines & tans. SOHCAHTOA.



$\sin 60 = \frac{\sqrt{3}}{2}$; $\cos 60 = \frac{1}{2}$

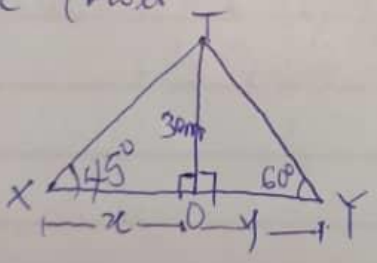
$\sin 30 = \frac{1}{2}$; $\cos 30 = \frac{\sqrt{3}}{2}$

$\sin 45 = \frac{1}{\sqrt{2}}$; $\cos 45 = \frac{1}{\sqrt{2}}$

$\tan 60 = \frac{\sqrt{3}}{1} = \sqrt{3}$; $\tan 30 = \frac{1}{\sqrt{3}}$; $\tan 45 = \frac{1}{1} = 1$

Let X & Y be the points on the opposite sides of the level ground.

Let O be the starting point & T be the top of the tower.



Using SOHCAHTOA,

$\tan 45 = \frac{30}{x}$; $x = \frac{30}{\tan 45} = \frac{30}{1} = 30$.

$\tan 60 = \frac{30}{y}$; $y = \frac{30}{\tan 60} = \frac{30}{\sqrt{3}} = \frac{30\sqrt{3}}{3} = 10\sqrt{3}$

$x + y = 30 + 10\sqrt{3} = 30 + 17.32 = 47.32\text{m}$

Ans: C

17. Know these; $\cos^2\theta + \sin^2\theta = 1$.

$\cos(A+B) = \cos A\cos B - \sin A\sin B$

$\cos(A-B) = \cos A\cos B + \sin A\sin B$

$\sin(A-B) = \sin A\cos B - \sin B\cos A$

$\sin(A+B) = \sin A\cos B + \sin B\cos A$

$\tan(A+B) = \dfrac{\tan A + \tan B}{1 - \tan A\tan B}$; ~~$\cos^2\theta + \sin^2\theta = 1$~~

$\tan(A-B) = \dfrac{\tan A - \tan B}{1 + \tan A\tan B}$.

$\cot A = \dfrac{1}{\tan A}$; $\operatorname{Cosec} A = \dfrac{1}{\sin A}$; $\sec A = \dfrac{1}{\cos A}$

$\tan A = \dfrac{\sin A}{\cos A}$; $\cot A = \dfrac{\cos A}{\sin A}$

$\cot(90-A) = \tan A$; $\cot(90+A) = -\tan A$.

Thus

$\cot 15 + \cot 75 + \cot 135 - \operatorname{Cosec} 30$

$= \cot 15 + \cot(90-15) + \cot(90+45) - \dfrac{1}{\sin 30}$

$= \cot 15 + \tan 15 - \tan 45 - \dfrac{1}{(1/2)}$

$= \dfrac{\cos 15}{\sin 15} + \dfrac{\sin 15}{\cos 15} - 1 - 2 = \dfrac{\cos^2 15 + \sin^2 15 - 3}{\sin 15\cos 15}$

Recall: $\cos^2\theta + \sin^2\theta = 1$ &
$\sin(A+B) = \sin A\cos B + \sin B\cos A$
Where $A = B$; $\sin 2A = 2\sin A\cos A$.

$= \dfrac{2}{2\sin 15\cos 15} - 3$

$= \dfrac{2}{\sin 30} - 3 = \dfrac{2}{(1/2)} - 3 = 4 - 3 = 1$.

ANS: C

18. Amount shared between A, B & C = Rs 432.

$8A = 12B = 6C$

Thus $8A = 12B$ — (1)

$8A = 6C$ — (2)

from (1): $B = \frac{8}{12}A$

from (2): $C = \frac{8}{6}A$.

Thus $A : B : C$

$= A : \frac{8A}{12} : \frac{8A}{6} = 6A : 4A : 8A$.

(gotten by multiplying through by 6 to remove the fractions)

$6 + 4 + 8 = 18$.

A's portion $= \frac{6}{18} \times 432 = 144$

Thus A's portion = Rs 144

Ans: C

19. 20men work for 12days for 8hrs to do a job.

$= 20 \times 12 \times 8$ *

The question said that, the new work is 4times the previous one.

$= 20 \times 12 \times 8 \times 4$.

Let n be the number of men if they work for 5 hrs in 12 days.

$n \times 5 \times 12 = 20 \times 12 \times 8 \times 4$

$n = \frac{20 \times 12 \times 8 \times 4}{5 \times 12} = 128$.

It will take 128men only to complete the new job.

But the question said that there are already 6women and 2boys on the job already.

M = Men, W = Women, B = Boys.

Equivalence:

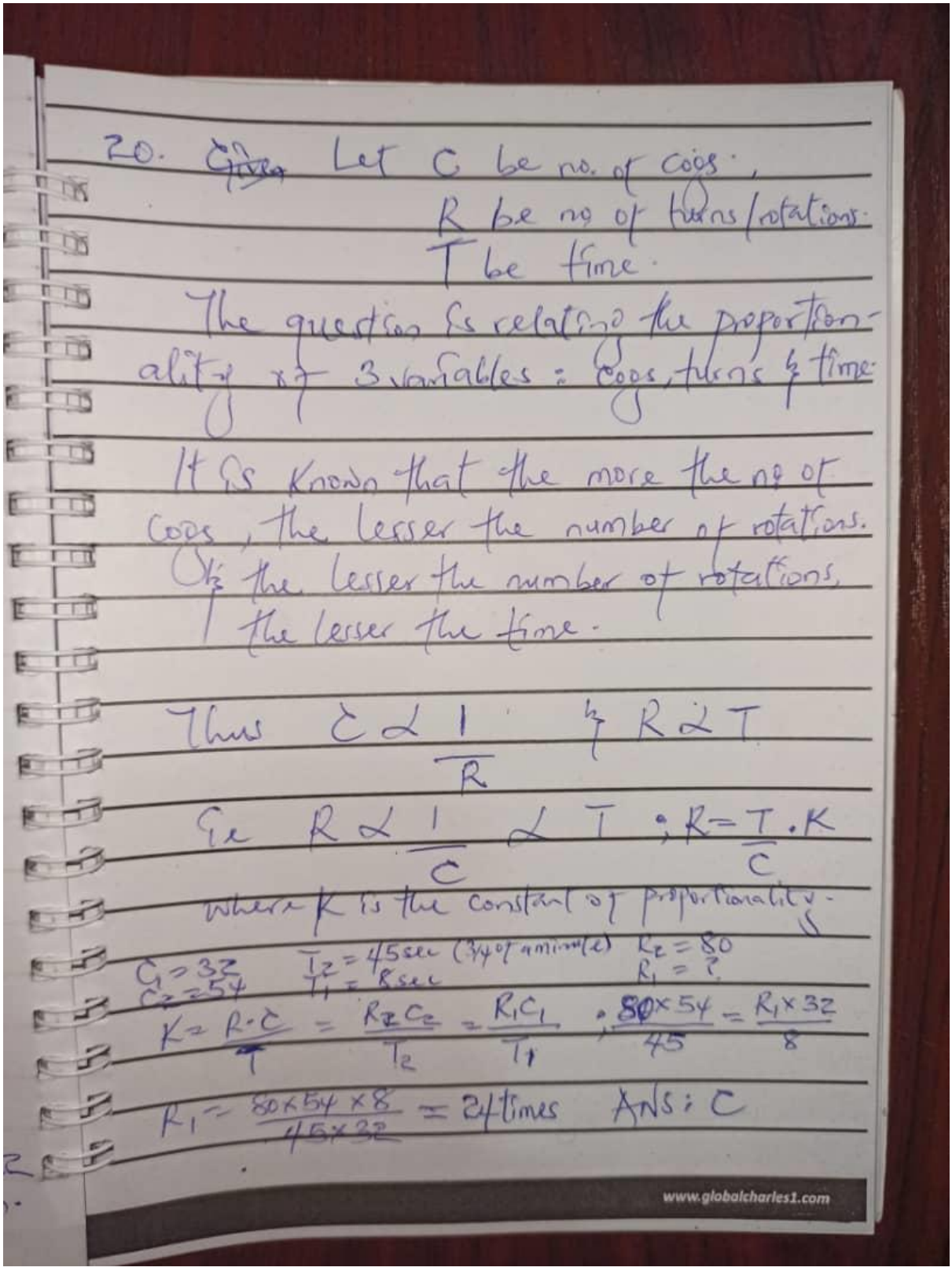
$24W = 20M$; $6W = 5M$

$40B = 20M$; $2B = 1M$.

Thus 6women = 5men & 2Boys = 1man.

So number of men required = $128 - (5+1) = 122$ men.

ANS: MISSING



20. Let C be no. of cogs,
R be no of turns/rotations
T be time.

The question is relating the proportionality of 3 variables: cogs, turns & time.

It is known that the more the no of cogs, the lesser the number of rotations. & the lesser the number of rotations, the lesser the time.

Thus $C \propto \frac{1}{R}$ & $R \propto T$

i.e $R \propto \frac{1}{C} \propto T$; $R = \frac{T}{C} \cdot K$

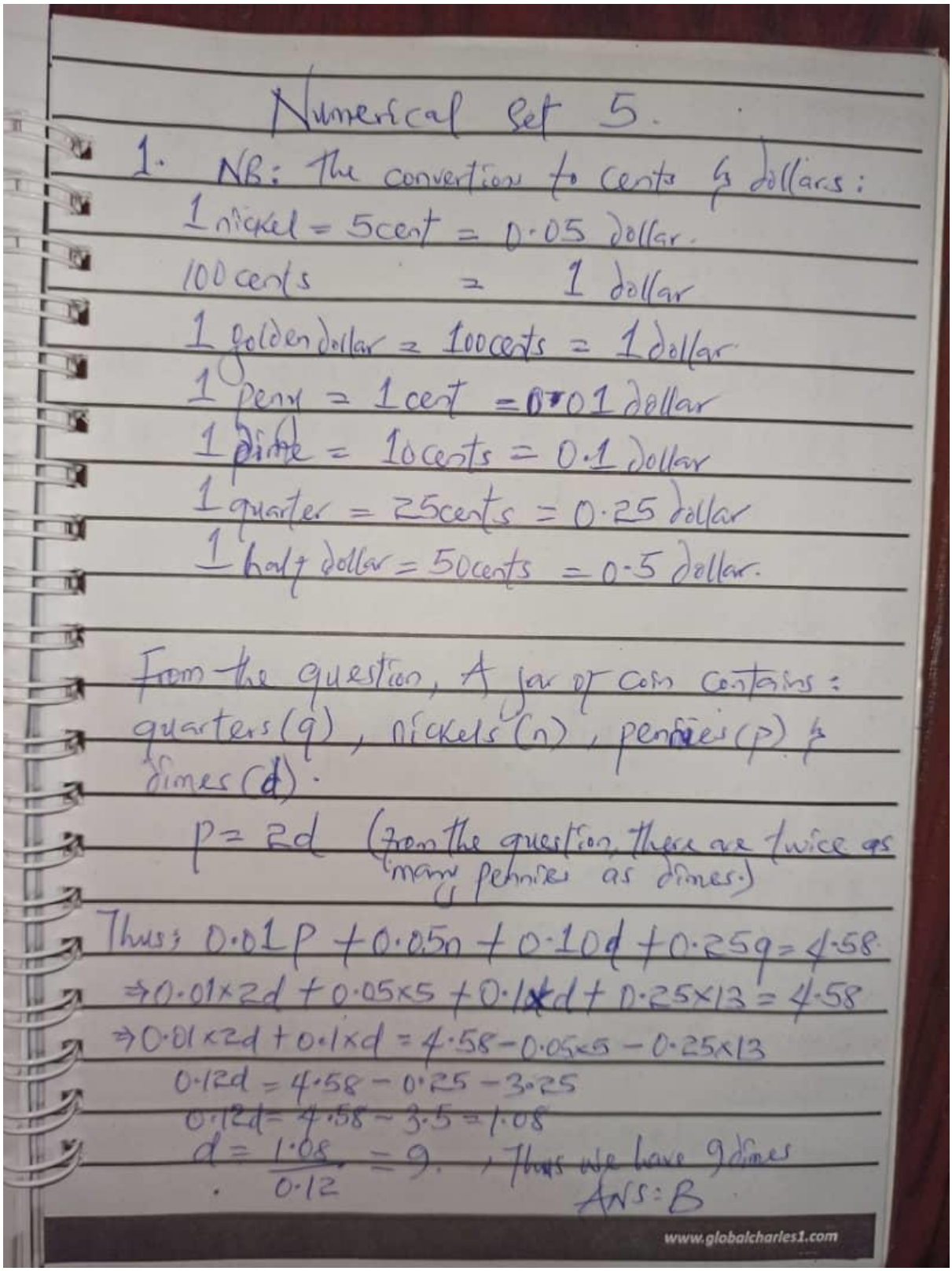
where K is the constant of proportionality.

$C_1 = 32$, $T_2 = 45\text{sec}$ (3/4 of a minute), $R_2 = 80$
$C_2 = 54$, $T_1 = 8\text{sec}$, $R_1 = ?$

$K = \frac{R \cdot C}{T} = \frac{R_2 C_2}{T_2} = \frac{R_1 C_1}{T_1}$; $\frac{80 \times 54}{45} = \frac{R_1 \times 32}{8}$

$R_1 = \frac{80 \times 54 \times 8}{45 \times 32} = 24\text{times}$ Ans: C

PART 5A



Numerical Set 5.

1. NB: The convertion to cents & dollars:

1 nickel = 5cent = 0.05 dollar.

100 cents = 1 dollar

1 golden dollar = 100cents = 1 dollar

1 penny = 1 cent = 0.01 dollar

1 dime = 10 cents = 0.1 dollar

1 quarter = 25cents = 0.25 dollar

1 half dollar = 50cents = 0.5 dollar.

From the question, A jar of coin contains: quarters(q), nickels(n), pennies(p) & dimes(d).

$p = 2d$ (from the question, there are twice as many pennies as dimes.)

Thus: $0.01p + 0.05n + 0.10d + 0.25q = 4.58$

$\Rightarrow 0.01 \times 2d + 0.05 \times 5 + 0.1 \times d + 0.25 \times 13 = 4.58$

$\Rightarrow 0.01 \times 2d + 0.1 \times d = 4.58 - 0.05 \times 5 - 0.25 \times 13$

$0.12d = 4.58 - 0.25 - 3.25$

$0.12d = 4.58 - 3.5 = 1.08$

$d = \frac{1.08}{0.12} = 9$, Thus we have 9 dimes

ANS: B

2. Time taken to pay off a loan $= \frac{5}{6}$ of 1yr

$= \frac{5}{6} \times 12 = 10$ months.

10months from March 1 is December 31st.
(Just as January 1 to December 31st is 1year)

Ans: D.

3. let x = no of oranges $= 3$.

$2x$ = no of oranges $= 2 \times 3$ (from the ~~quest~~ question, twice as many oranges as apple.)

c = no of cherries.

from the question;

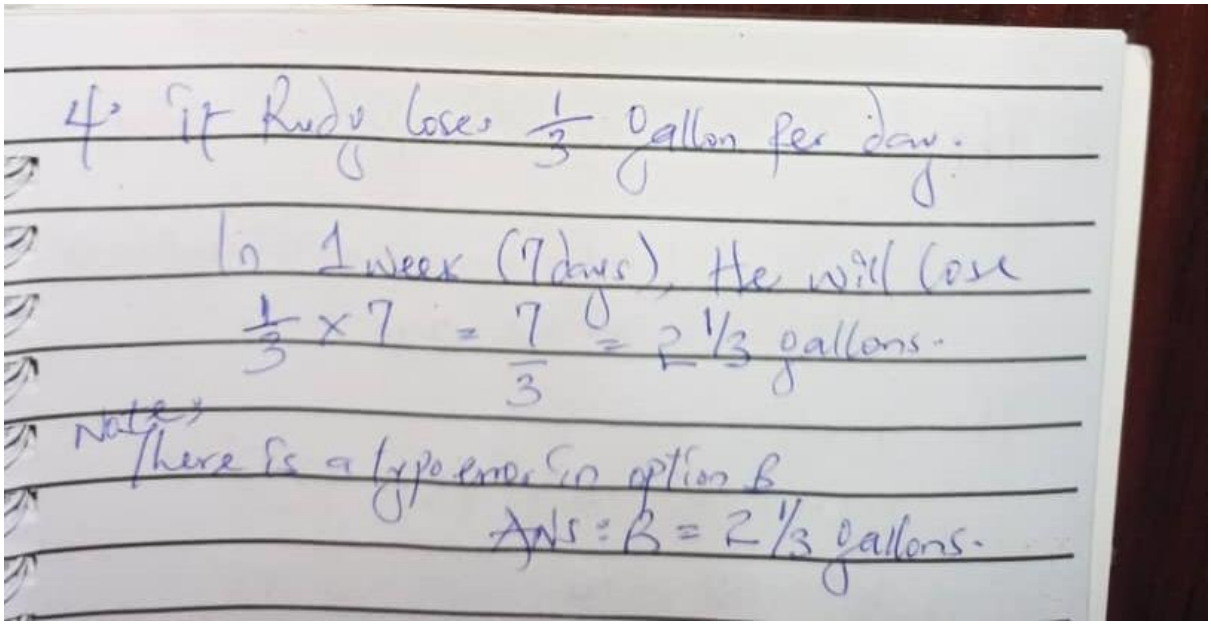
$$x + 2x = \frac{c}{2}$$

thus $3 + 2 \times 3 = \frac{c}{2}$; $2 \times (3+6) = c$

$18 = c$

Thus no of cherries is 18

Ans: B


4. If Rudy loses 1/3 gallon per day.
In 1 week (7 days), He will lose
1/3 × 7 = 7/3 = 2 1/3 gallons.
Note:
There is a typo error in option B
Ans: B = 2 1/3 gallons.

5. This is the actual expression from the question.

Let x be the number of initial birds on the oak tree.

The question said;

$$12(x+10)-16 = 4(x+10)$$

$$8(x+10) = 16$$

$$x+10 = 2$$

$$x = -8$$ which is not possible

but if we use BEFORE instead of AFTER in the question ie in the 2nd to last line of the question: tree had BEFORE the 10 landed,

the expression becomes:

$$12x-16 = 4(x+10)$$

$$12x-16 = 4x+40$$

$$12x-4x = 40+16 = 56$$

$$8x = 56$$

$$x = 56/8 = 7 \text{ birds.}$$

Ans: (using BEFORE instead of AFTER) is B.

6. Solve for b in $\sqrt{(b-4)} = 5$.

square both sides

$$\left(\sqrt{(b-4)}\right)^2 = 5^2$$

$$b - 4 = 25$$

$$b = 25 + 4 = 29.$$

ANS: D.

7. Let P = height of the picture &
C = height of ceiling.

from the question;

$$P = \frac{20}{100} \times C \; ; \; \text{P is given as 24 inches}$$

P is given as 24 inches.

$$24 = 0.2C \; ; \; C = \frac{24}{0.2} = 120 \text{ inches.}$$

Nb; 12 inches = 1 foot.

Thus if 12 inches = 1 ft,
120 inches = x,

$$x = \frac{120 \text{ inches}}{12 \text{ inches}} \times 1 \text{ ft} = 10 \text{ ft.}$$ ANS: B

8. Know this formula:

$W = \frac{xy}{x+y}$ — ① ; $W = \frac{xyz}{xy+yz+xz}$ — ② etc

W is time taken to do a particular task together,

x, y & z are individual time taken to do a particular job.

eqn ① is for 2 people and

eqn ② is for 3 people.

Using $W = \frac{xy}{x+y}$

let x be time taken by Belinda to do the job alone

y be the time taken by the Neighbour to do the job alone.

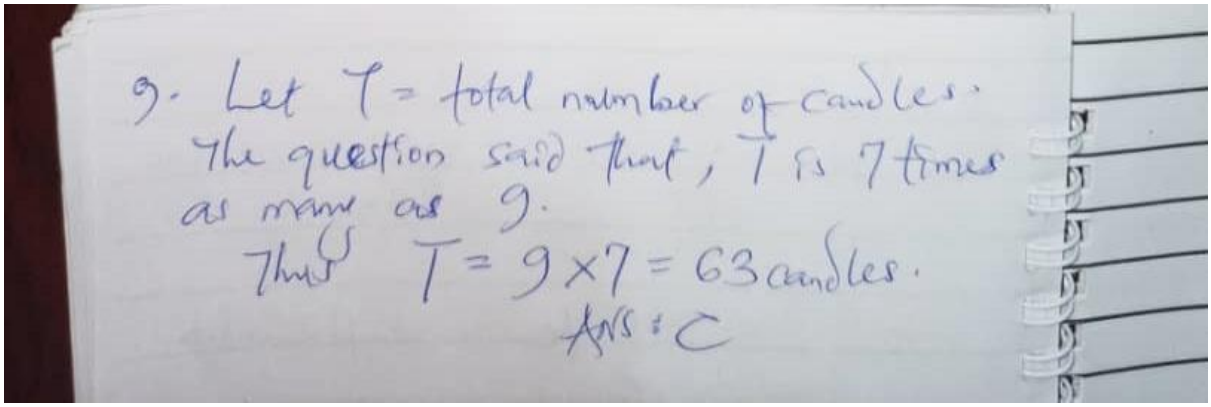
W be time taken to do the job together.

Thus; $22 = \frac{x \times 38}{x+38}$; $22(x+38) = 38x$

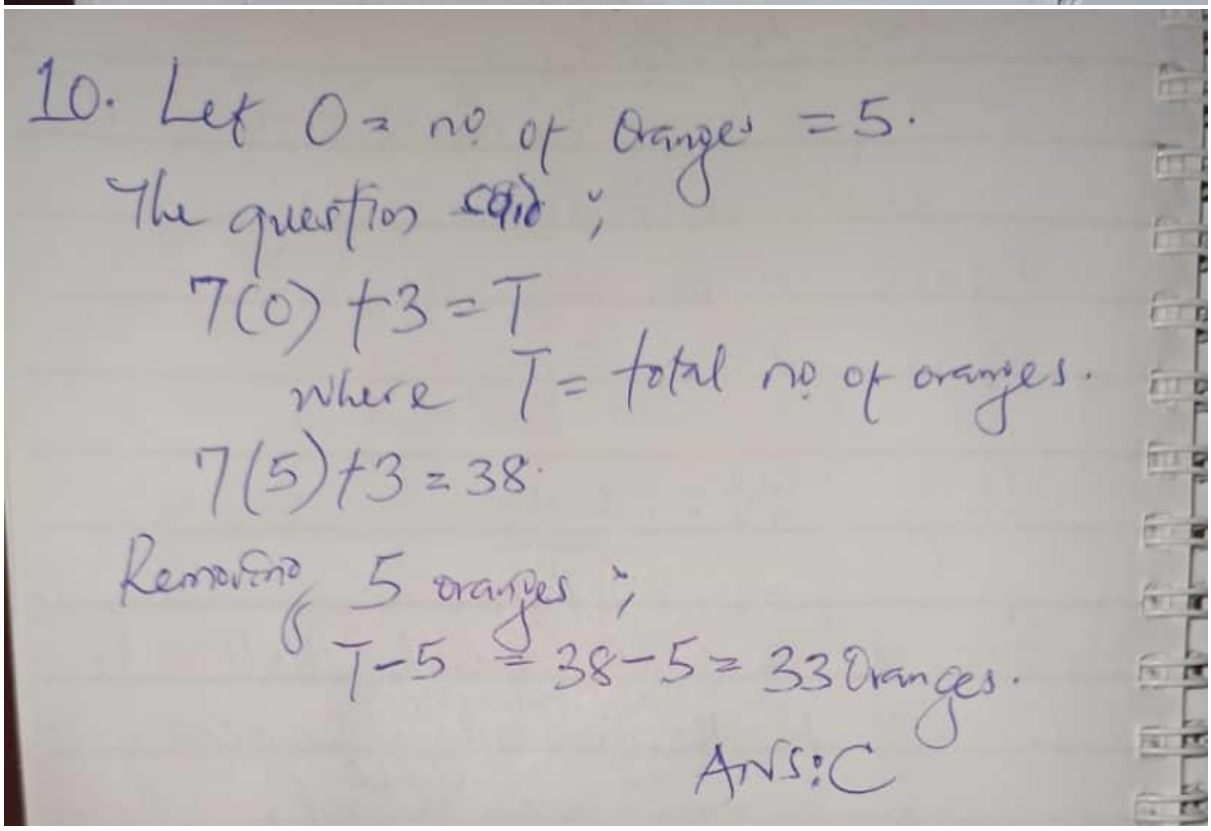
$22x + 22 \times 38 = 38x$; $38x - 22x = 22 \times 38$.

$16x = 22 \times 38$; $x = \frac{22 \times 38}{16} = 52.25 \text{ hrs}$.

Ans: D



9. Let T = total number of candles.
The question said that, T is 7 times as many as 9.
Thus $T = 9 \times 7 = 63$ candles.
Ans: C



10. Let O = no of Oranges = 5.
The question said;
$7(O) + 3 = T$
where T = total no of oranges.
$7(5) + 3 = 38$.
Removing 5 oranges;
$T - 5 = 38 - 5 = 33$ Oranges.
Ans: C

11. Let x = first candy costing $1 per ounce
y = Second candy costing $0.7 per ounce
z = Total yield mixture costing $0.80 per ounce.

x nos of 1$ + 6 nos of $0.7 = $(x+6)$ nos of 0.8$

Thus $1x + 6 \times 0.7 = (x+6) \times 0.8$

$x + 4.2 = 0.8x + 4.8$

$x - 0.8x = 4.8 - 4.2 = 0.6$

$0.2x = 0.6$;

$x = \frac{0.6}{0.2} = 3$

Thus 3 ounces of first candy costing $1 is required.

Ans : B

12. Remember ; $W = \frac{xy}{x+y}$

Where W = Time taken for both to do the work together.

x = Time taken for the first person to do the work alone

y = Time taken for the second person to do the work alone

Thus $x = 4$, $y = 3$, $W = ?$

$W = \frac{4 \times 3}{4+3} = \frac{12}{7} = 1\frac{5}{7}$ hrs. $= 1.71$ hrs

Ans: A

13. Speed $= \frac{\text{distance}}{\text{time}}$; distance = speed x time

time $= \frac{\text{distance}}{\text{speed}} = \frac{5}{3} = 1.67$ hrs

Ans: B.

14. Let x time of class.

$J = x - 10$ — ①

$D = m + 4$ — ②

$M = \frac{x - 10}{2} = x - 5$ — ③

Put ③ in ②,

$D = x - 5 + 4 = x - 1$

Thus Dee was 1 minute early before the class. Ans: A.

15. $I = \frac{PRT}{100}$; $A = P + I$.

Given: $A = 50$, $P = 45$, $T = \frac{1 \text{ month}}{12} = \frac{1}{12}$ yrs.

$R = ?$

$I = A - P = 50 - 45 = 5$.

$I = \frac{PRT}{100}$; $5 = \frac{45 \times R \times \frac{1}{12}}{100}$; $5 \times 100 = \frac{45R}{12}$

$45R = 500 \times 12$; $R = \frac{500 \times 12}{45} = 133.33\%$

Ans: D

16. Total no that entered the Room = R = 12.

No of people that left, $L = 3 + \frac{2}{3}R$.

$L = 3 + \frac{2}{3} \times 12 = 3 + 8 = 11$.

Total no of people remaining = 12 − 11 = 1 person

Thus 1 person is remaining.

Ans: B.

17. ~~$\frac{1}{4}$ inches reps : 2 feet.~~

4 inches reps x.

$x * \frac{1}{4} = 4 \times 2$; $x = 4 \times 4 \times 2$

$= 32$ feet.

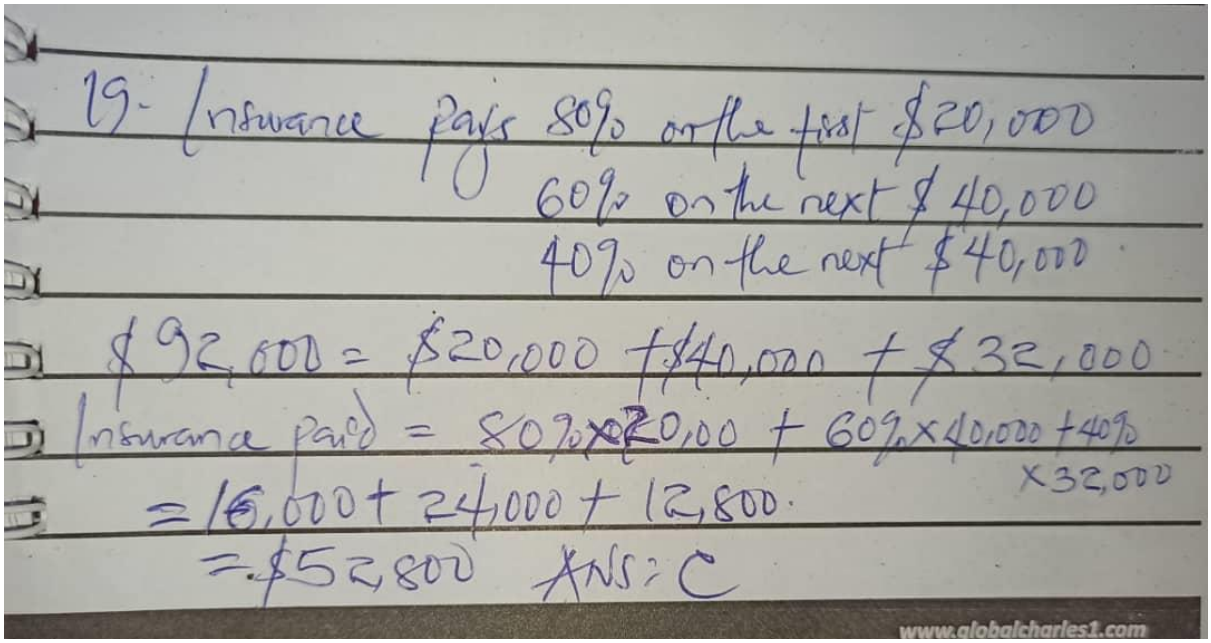
Ans: D.

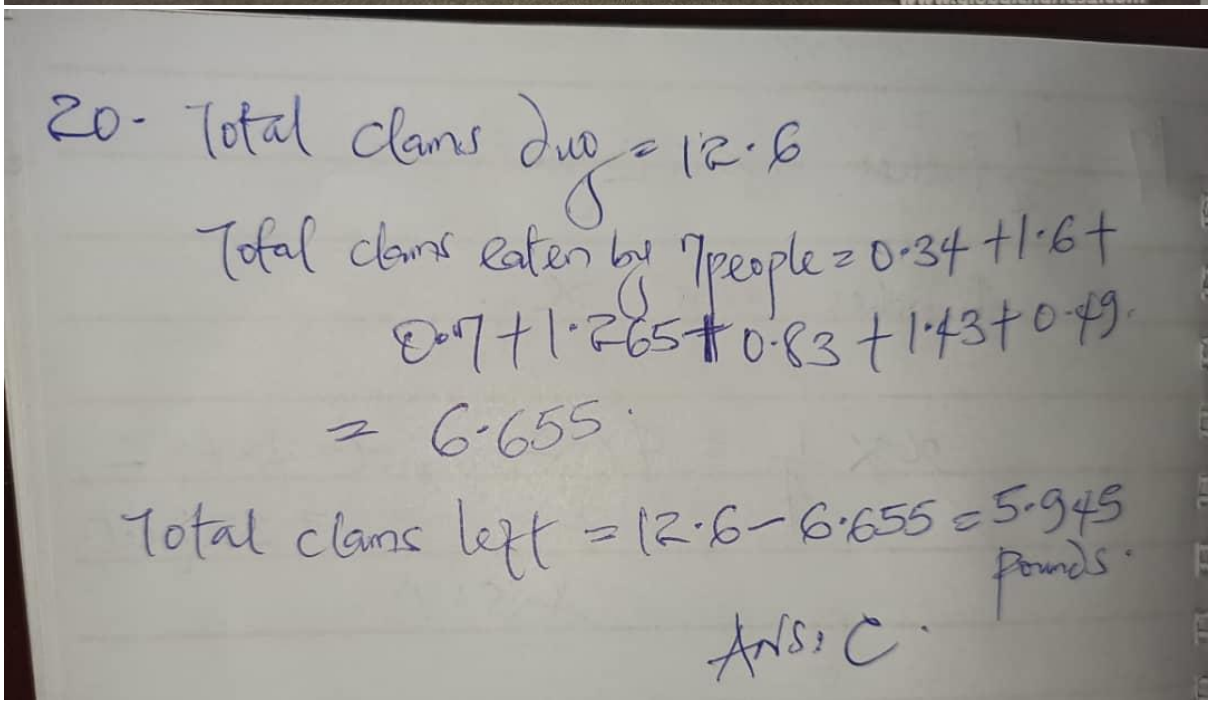
18. 150% Increment on \$45.

$\frac{150}{100} \times 45 = \$67.50$.

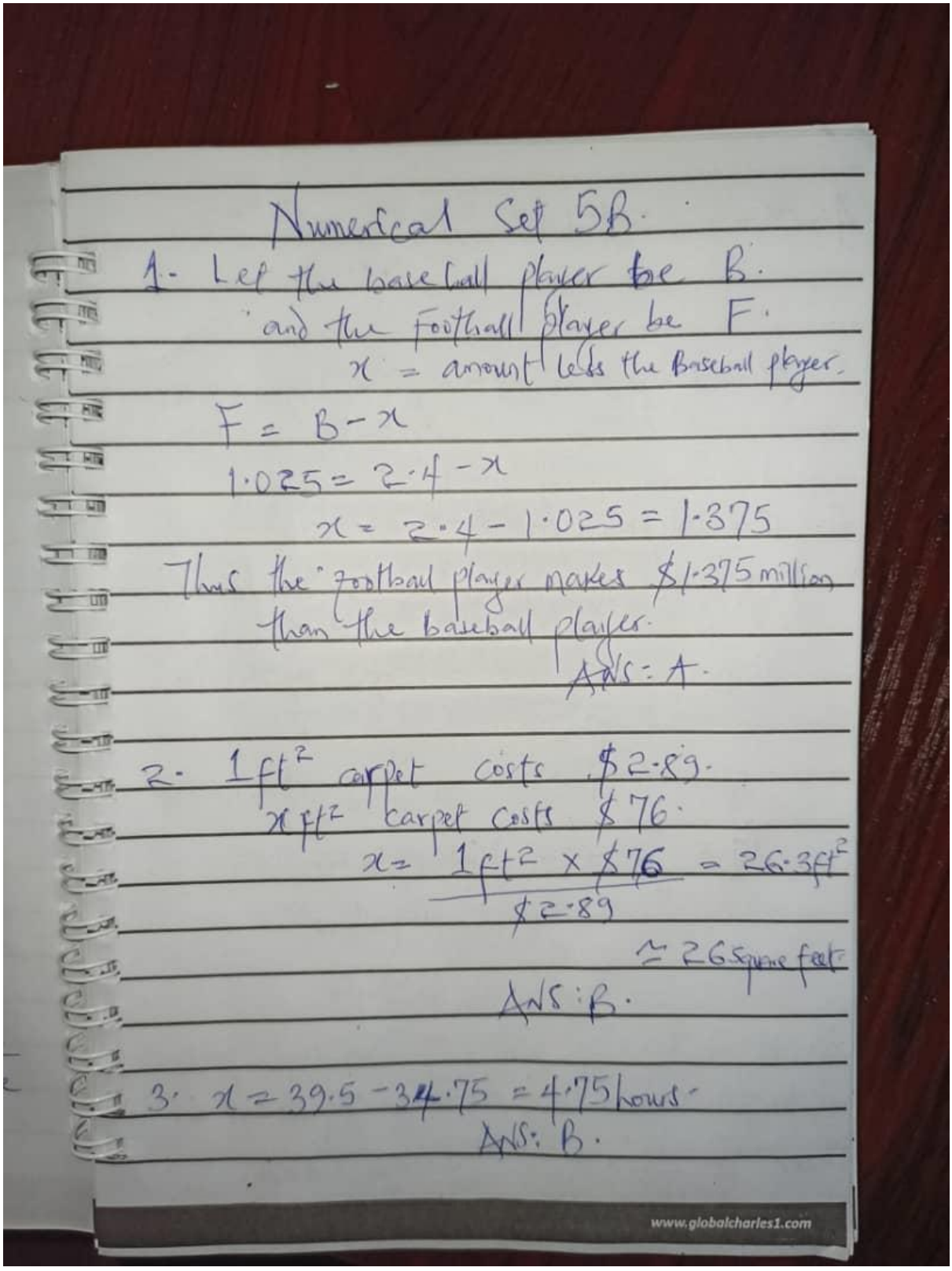
\$45 + \$67.50 = \$112.50

Ans: D.


19. Insurance pays 80% on the first $20,000
60% on the next $40,000
40% on the next $40,000.
$92,000 = $20,000 + $40,000 + $32,000
Insurance paid = 80% × 20,00 + 60% × 40,000 + 40% × 32,000
= 16,000 + 24,000 + 12,800.
= $52,800 ANS: C
www.globalcharles1.com


20. Total clams due = 12.6
Total clams eaten by 7 people = 0.34 + 1.6 +
0.07 + 1.265 + 0.83 + 1.43 + 0.49.
= 6.655.
Total clams left = 12.6 − 6.655 = 5.945 pounds.
ANS: C.

PART 5B



Numerical Set 5B.

1. Let the baseball player be B.
and the Football player be F.
x = amount less the Baseball player.

$F = B - x$

$1.025 = 2.4 - x$

$x = 2.4 - 1.025 = 1.375$

Thus the football player makes $1.375 million than the baseball player.

Ans: A.

2. $1ft^2$ carpet costs $2.89.
$x ft^2$ carpet costs $76.

$x = \frac{1ft^2 \times \$76}{\$2.89} = 26.3ft^2$

$\simeq$ 26 Square feet

Ans: B.

3. $x = 39.5 - 34.75 = 4.75$ hours.

Ans: B.

4. $x = 0.25 + 1.02 + 0.36 = 1.63$ acres.
Ans: A.

5. $x = 15.6 \times 27.75 = 432.9$ square feet.
Ans: D.

6. $R = 100$ gallons/minute.
50% of 100 gallons/minute = 50 gallons/minute.

$$\text{Rate} = \frac{\text{No of gallons}}{\text{Time}} \; ; \; T = \frac{G}{R}$$

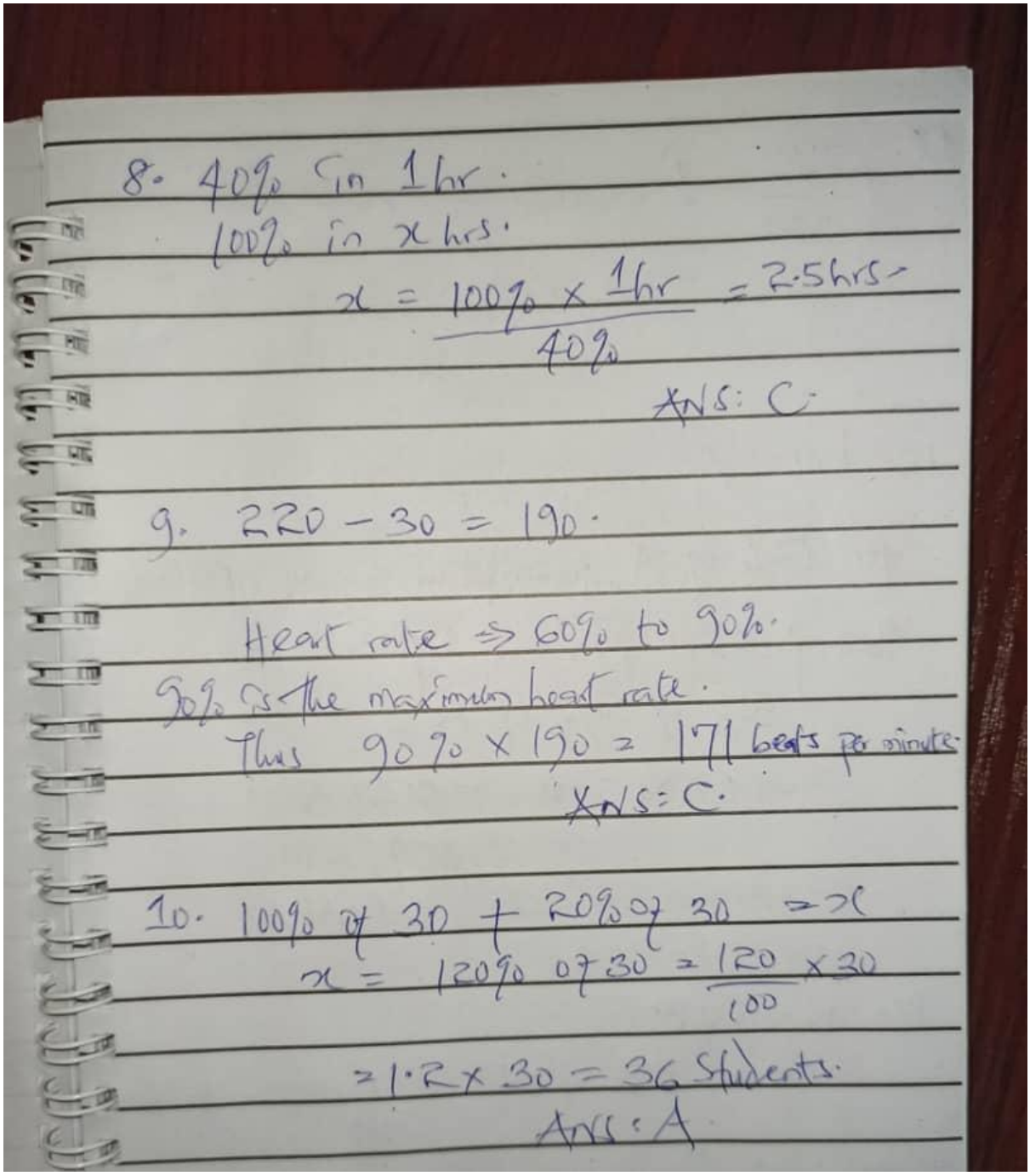
Where T = time, G = no of gallons, R = Rate.

$G = T \times R = (6 \times 60) \times 50 :$
$= 18{,}000$ gallons.
Ans B.

7. M grades 5 papers per hour ; J grades 4 papers per hour
In 3hrs, M grades $3 \times 5 = 15$; In 2hrs, J grades $2 \times 4 = 8$.

$$\Rightarrow \frac{15+8}{50} \times 100\% = \frac{23}{50} \times 100\% = 46\%$$

Ans: B.



8. 40% in 1 hr.
100% in x hrs.
$x = \frac{100\% \times 1\text{hr}}{40\%} = 2.5\text{hrs}$
ANS: C.

9. 220 − 30 = 190.
Heart rate ⇒ 60% to 90%.
90% is the maximum heart rate.
Thus 90% × 190 = 171 beats per minute.
ANS: C.

10. 100% of 30 + 20% of 30 = x
$x = 120\%\ \text{of}\ 30 = \frac{120}{100} \times 30$
$= 1.2 \times 30 = 36$ students.
ANS: A

11. $\left(\frac{279}{350} - 1\right) \times 100\% = -20.29\%$

Thus 20% discount.

Ans: A.

12. Let A = Allergy sufferers.

For 50% of A, prescription is 50% effective.

Thus prescription is only effective for

= 50% of 50% of A

$= 0.5 \times 0.5 \times A = 0.25A.$

= 25%.

Ans: A.

13. W = $423.

Tax = 19% of 423 $= \frac{19}{100} \times 423 = 80.37$

Take Home = 423 − 80.37 = $342.63.

OR Take Home = (100 − 19)% of 423

= 81% × 423 = $342.63

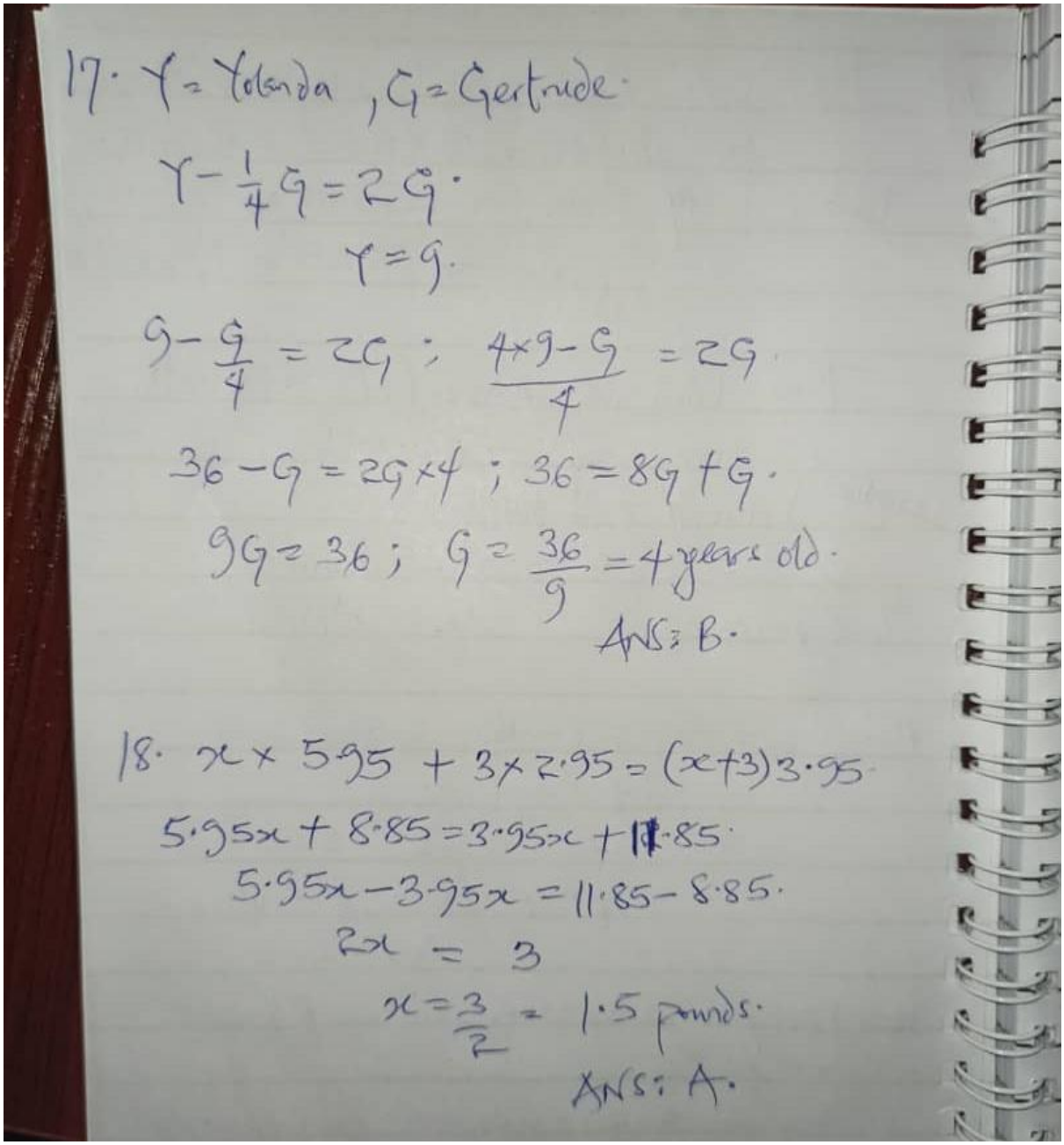
Ans: C

14. Timi sells 20 glasses for 10 cents per glass
for 20 glasses = 10 × 20 = 200 cents.
Timi sells 7 glasses for 25 cents per glass
for 7 glasses = 7 × 25 = 175 cents.

Thus Timi will make (175 − 200) cents
More = −25 cents.
100 cents = 1 dollar.
−25 cents = −0.25 dollar.
(Timi loses $0.25). Ans: A.

15. B = 5 ; T = B/2 = 5/2 = 2.5
J = T + (B − T)/2
= 2.5 + (5 − 2.5)/2 = 2.5 + 2.5/2
= 2.5 + 1.25 = 3.75 miles.
Ans: B.

16. P = 6A. ; A = 5B ; B = $4000
V = ½P.
Thus A = 5 × 4,000 = 20,000 ; P = 6 × 20,000
= 120,000.
V = 120,000/2 = $60,000.
Ans: B



17. Y = Yolanda, G = Gertrude.

$Y - \frac{1}{4}G = 2G$.

$Y = 9$.

$9 - \frac{G}{4} = 2G$; $\frac{4 \times 9 - G}{4} = 2G$

$36 - G = 2G \times 4$; $36 = 8G + G$.

$9G = 36$; $G = \frac{36}{9} = 4$ years old.

ANS: B.

18. $x \times 5.95 + 3 \times 2.95 = (x+3)3.95$

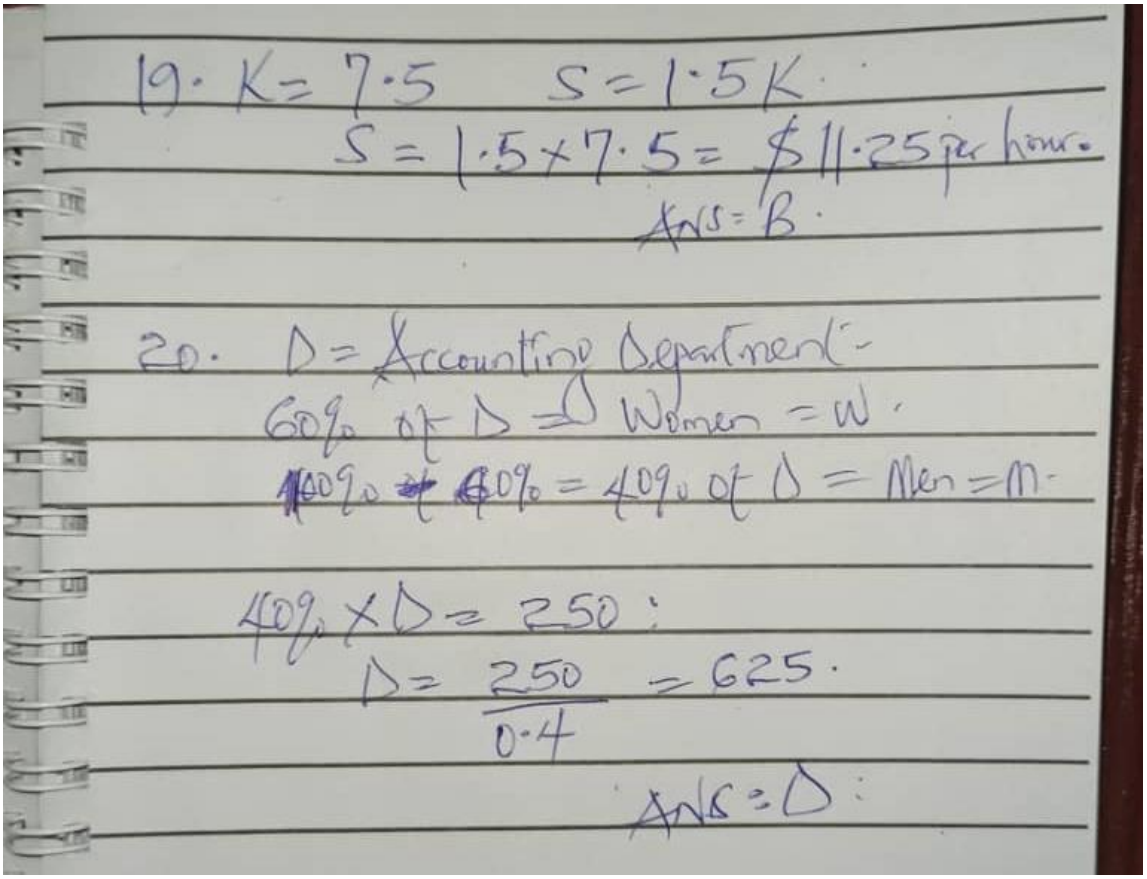
$5.95x + 8.85 = 3.95x + 11.85$.

$5.95x - 3.95x = 11.85 - 8.85$.

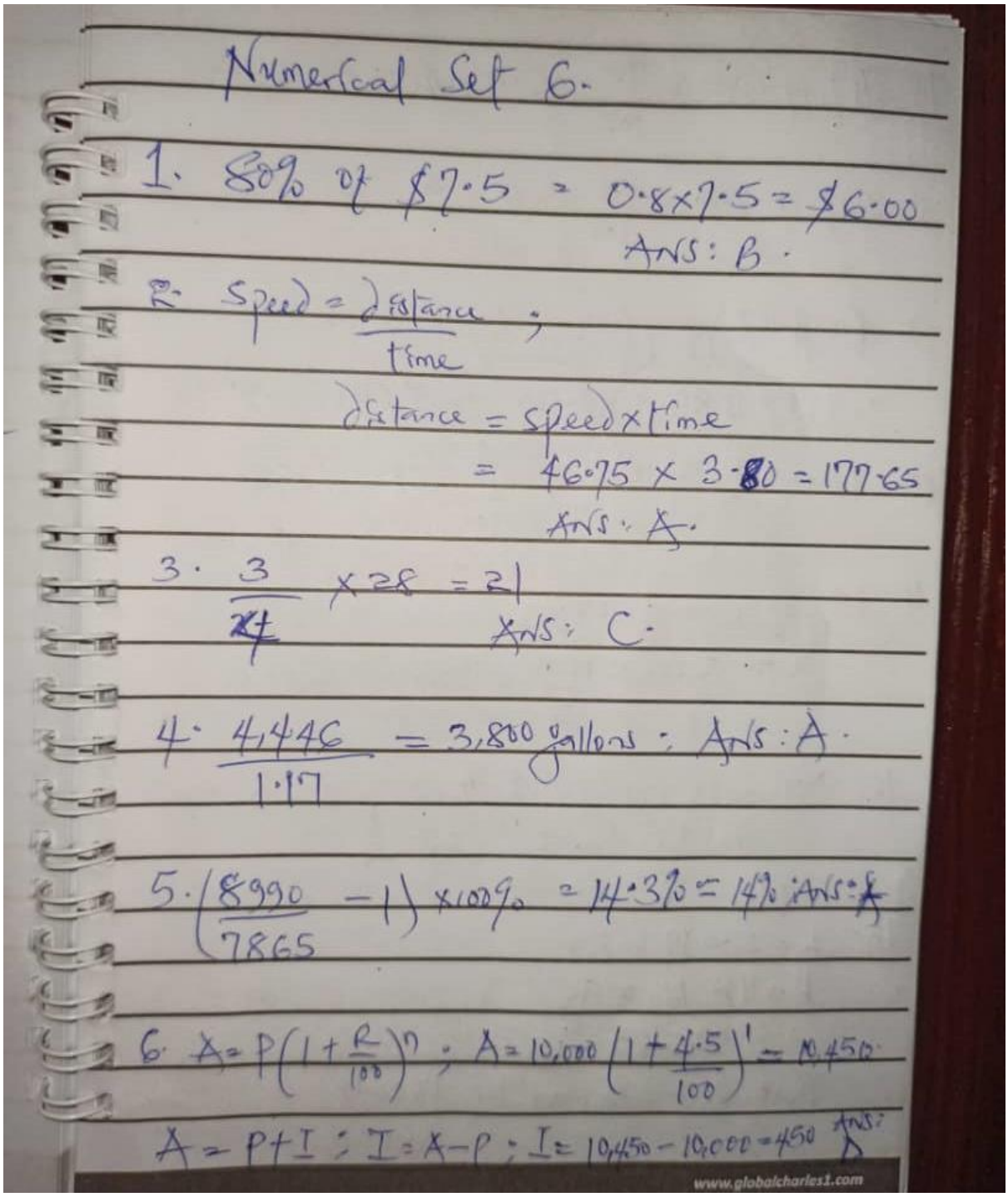
$2x = 3$

$x = \frac{3}{2} = 1.5$ pounds.

ANS: A.


19. K = 7.5 S = 1.5K.
S = 1.5 × 7.5 = $11.25 per hour.
Ans = B.
20. D = Accounting Department.
60% of D = Women = W.
40% of 40% = 40% of D = Men = M.
40% × D = 250.
D = 250 / 0.4 = 625.
Ans = D.

PART 6


Numerical Set 6.
1. 80% of $7.5 = 0.8×7.5 = $6.00
Ans: B.
2. Speed = distance / time ;
distance = speed × time
= 46.75 × 3.80 = 177.65
Ans: A.
3. 3/27 × 28 = 21
Ans: C.
4. 4,446 / 1.17 = 3,800 gallons ; Ans: A.
5. (8990/7865 − 1) ×100% = 14.3% = 14% Ans:
6. A = P(1 + R/100)^n ; A = 10,000(1 + 4.5/100)^1 = 10,450
A = P + I ; I = A − P ; I = 10,450 − 10,000 = 450 Ans:
www.globalcharles1.com

7. 70% of $600 = \frac{70}{100} \times 600 = 420$ ANS: A

8. 40% of $240 = \frac{40}{100} \times 240 = 96$ ANS: B

9. $(100\% - 10\%)$ of $(100\% - 15\%)$ of $\$84.50$.
$= 0.9 \times 0.85 \times 84.50 = \$64.65$ ANS: B

10. $(100 - 32)\%$ of $400 = \frac{68}{100} \times 400 = 272$
ANS: B

11. 15% of $x = 3,000$.
$x = 3,000 \times \frac{100}{15} = 20,000$ ANS: B.

12. Difference between 1yr 7month & 2yrs 8months.
is 1yr 1month. ANS: A.

13. $K = 5 \times 17 = 85$
$R = 7 \times 14 = 98$
$98 - 85 = 13$
Thus Rani sold more by 13 cents.
ANS: B.

14. Speed = $\frac{\text{Distance}}{\text{time}} = \frac{300}{6} = 50$ miles per hr.

ANS: A.

15. Speed = $\frac{\text{Distance}}{\text{time}} = \frac{5\text{Kms}}{20\text{minutes}}$

20minutes = 1/3 hrs.

This speed = $5 \times 3 = 15$Kms per hr.

ANS: B.

16. 4Feet > 3Feet TRUE

7 Feet < 6Feet FALSE

5 Feet > 6 Feet FALSE

3 Feet < 2Feet FALSE.

ANS: A.

17. Prime numbers are numbers that are only divisible by itself and 1.

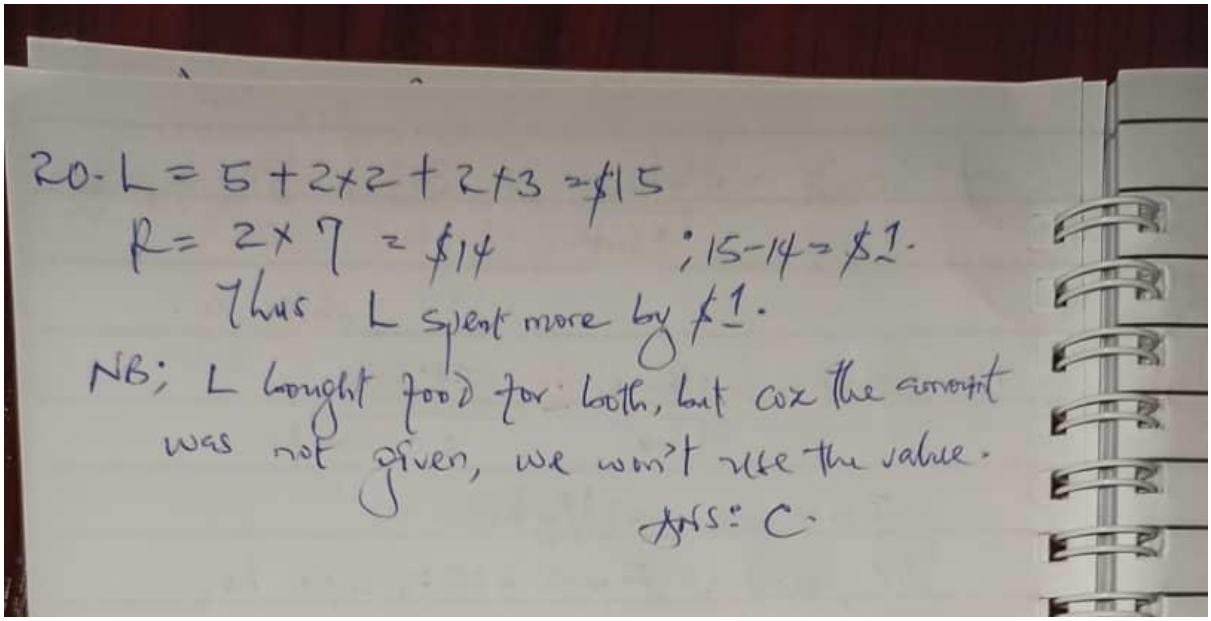
ANS: C.

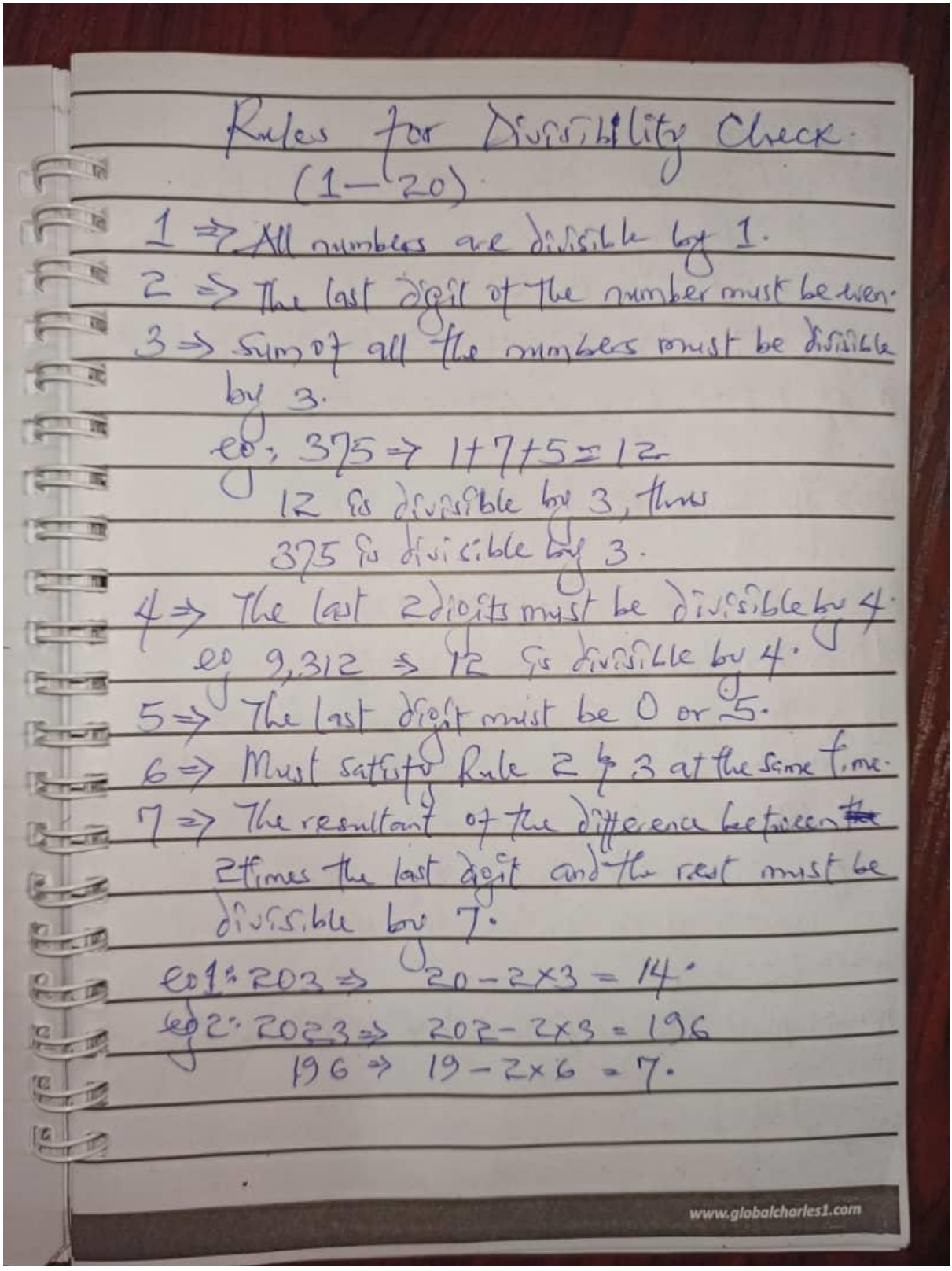
18. $S = R + 10$. ; ANS: D.

19. $^4P_4 = \frac{4!}{(4-4)!} = \frac{4!}{0!} = \frac{4 \times 3 \times 2 \times 1}{1} = 24$.

NB: $0! = 1$

ANS: B.


20. L = 5 + 2×2 + 2+3 = $15
R = 2×7 = $14 ; 15-14 = $1.
Thus L spent more by $1.
NB; L bought food for both, but coz the amount was not given, we won't use the value.
Ans: C.


Rules for Divisibility Check.
(1–20).
1 ⇒ All numbers are divisible by 1.
2 ⇒ The last digit of the number must be even.
3 ⇒ Sum of all the numbers must be divisible by 3.
eg: 375 ⇒ 1+7+5=13
13 is divisible by 3, thus
375 is divisible by 3.
4 ⇒ The last 2 digits must be divisible by 4.
eg 9,312 ⇒ 12 is divisible by 4.
5 ⇒ The last digit must be 0 or 5.
6 ⇒ Must satisfy Rule 2 & 3 at the same time.
7 ⇒ The resultant of the difference between 2 times the last digit and the rest must be divisible by 7.
eg1: 203 ⇒ 20-2×3 = 14.
eg2: 2023 ⇒ 202-2×3 = 196
196 ⇒ 19-2×6 = 7.
www.globalcharles1.com

8 ⇒ The resultant of the addition between the last digit and 2 times the rest must be divisible by 8.

eg: 56 ⇒ (5×2)+6 = 16.

OR: The last 3 digits must be divisible by 8.

eg 1,238,424 ⇒ 424 ÷ 8 = 53.

9 ⇒ The sum of all the digits must be divisible by 9.

eg: 1,278 ⇒ 1+2+7+8 = 18.

10 ⇒ The last digit must be 0.

11 ⇒ The difference between sums of the alternating numbers must be divisible by 11.

eg 10,813 ⇒ (1+8+3)−(0+1) = 11.

OR: Subtract the last digit from the rest, the result must be divisible by 11

eg 627 ⇒ 62−7 = 55.

12 ⇒ Must satisfy Rule 3 & 4 at the same time.

13 ⇒ From the alternating sum (from subtraction to addition) of blocks of 3 from right to left. The result must be divisible by 13.

eg: 2,911,272 ⇒ 272 − 911 + 2 = −637.

OR: Add 4 times the last digit to the rest. The result must be divisible by 13.

eg: 637 ⇒ 63 + 7×4 = 91

91 ⇒ 9 + 1×4 = 13.

14 ⇒ Must satisfy Rule 2 & 7 at the same time.

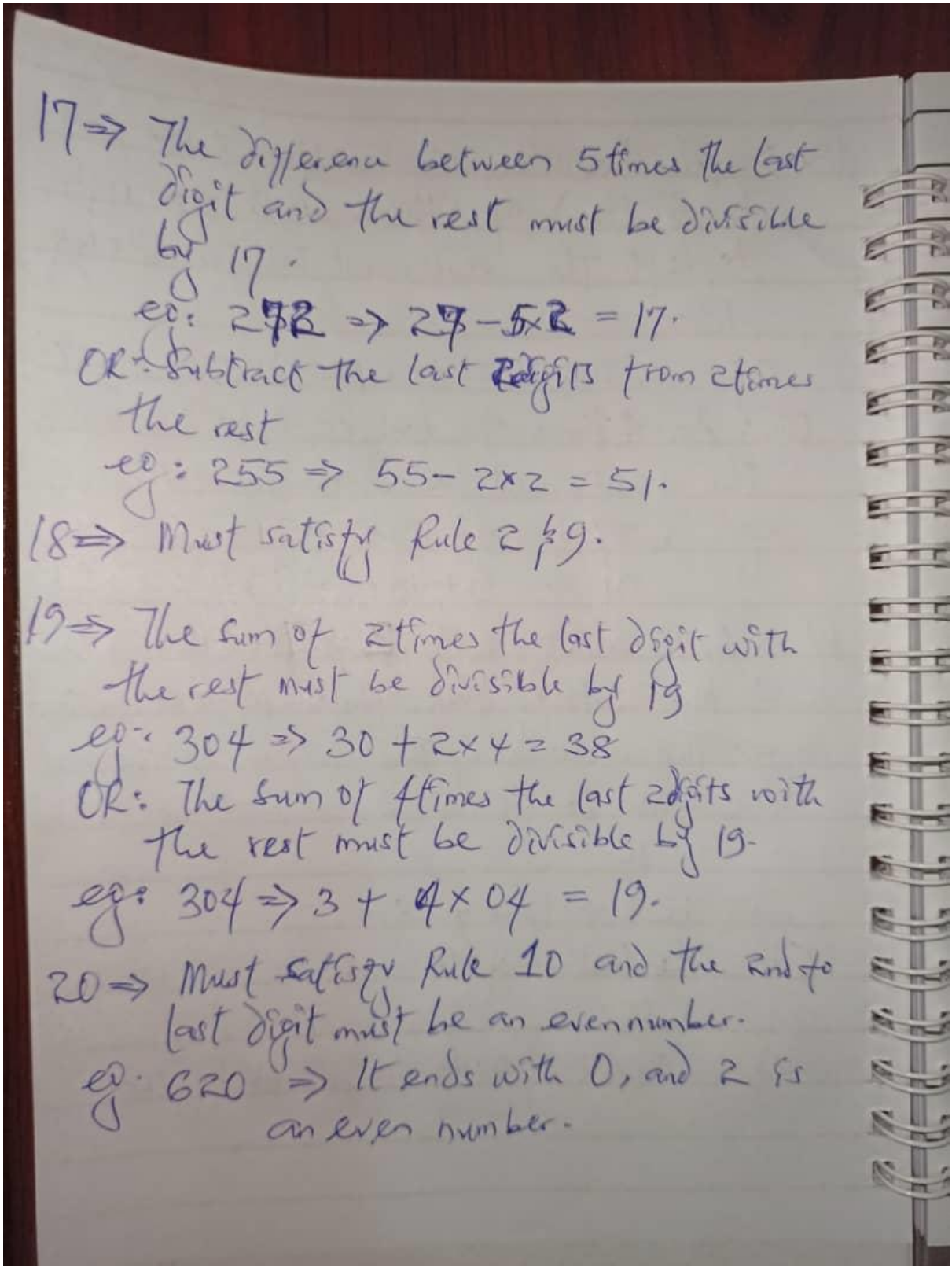
15 ⇒ Must satisfy Rule Rule 3 & 5 at the same time.

16 ⇒ The resultant of the addition of the last 2 digits to 4 times the rest must be divisible by 16.

eg 128 ⇒ 1×4 + 28 = 32

OR: The last 4 digits must be divisible by 16.

eg: 40,048 ⇒ 0048 is divisible by 16.



17 ⇒ The difference between 5 times the last digit and the rest must be divisible by 17.

eg: 272 ⇒ 27 − 5×2 = 17.

OR: Subtract the last 2 digits from 2 times the rest

eg: 255 ⇒ 55 − 2×2 = 51.

18 ⇒ Must satisfy Rule 2 & 9.

19 ⇒ The sum of 2 times the last digit with the rest must be divisible by 19

eg: 304 ⇒ 30 + 2×4 = 38

OR: The sum of 4 times the last 2 digits with the rest must be divisible by 19.

eg: 304 ⇒ 3 + 4×04 = 19.

20 ⇒ Must satisfy Rule 10 and the 2nd to last digit must be an even number.

eg: 620 ⇒ It ends with 0, and 2 is an even number.