## WORD PROBLEMS INVOLVING QUADRATIC EQUATIONS.

## Write your answers on separate paper.

1(a) When a number " $x$ " is squared, the result is 12 less than 8 times $\boldsymbol{x}$.
Form an equation and solve it to find $\boldsymbol{x}$.
(b) When a certain positive number is squared the result is 14 plus 5 times the original number.
Form an equation and solve it to find $\boldsymbol{x}$.

2(a) One side of a rectangle is 4 cm longer than the other side. The area of the rectangle is $96 \mathrm{~cm}^{2}$. Form an equation and solve it to find the length of each side.
(b) One side of a rectangle 1 cm longer than twice the shorter side. The area is $36 \mathrm{~cm}^{2}$. Form an equation and solve it to find the length of each side.

3(a) If " $x$ " is any whole number, what would the next consecutive whole number?
(b) If two consecutive whole numbers are squared then added together, the sum is 85 . Form an equation and solve it to find them.

4(a) If an EVEN number is $\boldsymbol{x}$, what would be the next even number?
(b) If two consecutive even numbers are squared then added together, the sum is 164 . Form an equation and solve it to find them.
5. A display rocket is fired vertically upwards. Its height h , at t secs is $\mathrm{h}=60 \mathrm{t}-5 \mathrm{t}^{2}$.
The rocket explodes when it reaches a height of 160 metres.
Find the time when it explodes.
(why do you get 2 answers?)
6. A special bomb is designed to explode when a pressure device inside it reaches 240 Pascals. The pressure $P$, at $t$ secs after the pin is pulled is given by $\mathrm{P}=100 \mathrm{t}-10 \mathrm{t}^{2}$.
(a) Find P when $\mathrm{t}=1 \mathrm{sec}$
(b) Find P when $\mathrm{t}=2 \mathrm{sec}$
(c) At what time will P reach 240 Pa ?
7. The temperature (T) in a laboratory heater at t minutes from turning it on, is given by: $\mathrm{T}=20+8 \mathrm{t}-\mathrm{t}^{2}$
(a) Find the temperature at the instant it is turned on at $\mathrm{t}=0 \mathrm{sec}$.
(b) Find T at $\mathrm{t}=1 \mathrm{~min}$.
(c) A certain bacterial culture has to be removed the instant the temperature reaches $35^{\circ} \mathrm{C}$. Find at what time this will be.
8. A rectangular room has an area of $42 \mathrm{~m}^{2}$. When a square carpet is put in one corner, the width of the strips of floor left uncovered are 1 m and 2 m .
(a) Draw a diagram and use $\boldsymbol{x}$ to represent the length of each side of the carpet.
(b) Find the area of the carpet square.
9. An area can be covered by 100 square tiles of side " $x$ " cm .
(a) What is the area in terms of $\boldsymbol{x}$ ?
(b) A smaller tile is used which has each side 10 cm smaller than the other tiles. What is the area of each smaller tile in terms of " $x$ " ?
(c) If it takes 400 of the smaller tiles to cover the same area as 100 of the larger tiles, find the size of each type of tile and the total area to be covered.

## ANSWERS

1(a) When a number " $x$ " is squared, the result is 12 less than 8 times $\boldsymbol{x}$.
Form an equation and solve it to find $\boldsymbol{x}$.

$$
x^{2}=8 x-12 \text { so } \quad \begin{array}{r}
x^{2}-8 x+12=0 \\
(x-2)(x-6)=0
\end{array}
$$

$x$ could be 2 or 6 . Both are valid.
(b) When a certain positive number is squared the result is 14 plus 5 times the original number.
Form an equation and solve it to find $\boldsymbol{x}$.

$$
x^{2}=5 x+14 \quad \text { so } \quad \begin{array}{r}
x^{2}-5 x-14=0 \\
(x+2)(x-7)=0
\end{array}
$$

$x$ could be -2 or 7 .
The number is positive so only $x=7$ is valid
2(a) One side of a rectangle is 4 cm longer than the other side. The area of the rectangle is $96 \mathrm{~cm}^{2}$. Form an equation and solve it to find the length of each side.

Let sides be $x$ and $x+4$
Area is $x(x+4)=96$
$x^{2}+4 x-96=0$
$(x-8)(x+12)=0$
$x=8$ or -12
but only valid value is 8
sides are 8 and 12
(b) One side of a rectangle 1 cm longer than twice the shorter side. The area is $36 \mathrm{~cm}^{2}$. Form an equation and solve it to find the length of each side.

Let sides be $x$ and $2 x+1$
Area is $\quad x(2 x+1)=36$
$2 x^{2}+x-36=0$
$(2 x+9)(x-4)=0$
$x=-4.5$ or -4
but only valid value is 4
sides are 4and 9

3(a) If " $x$ " is any whole number, what would the next consecutive whole number?

$$
x+1
$$

(b) If two consecutive whole numbers are
squared then added together, the sum is 85 .
Form an equation and solve it to find them.
$x^{2}+(x+1)^{2}=85$
$x^{2}+x^{2}+2 x+1=85$
$2 x^{2}+2 x-84=0$
$x^{2}+x-42=0$
$(x-6)(x+7)=0$
So $x=6$ or -7 but this is not a whole $N^{o}$
So numbers are 6 and 7
4(a) If an EVEN number is $\boldsymbol{x}$, what would be the next even number?

$$
x+2
$$

(b) If two consecutive even numbers are squared then added together, the sum is 164 . Form an equation and solve it to find them.

$$
\begin{aligned}
& x^{2}+(x+2)^{2}=164 \\
& x^{2}+x^{2}+4 x+4=164 \\
& 2 x^{2}+4 x-160=0 \\
& x^{2}+2 x-80=0 \\
& (x-8)(x+10)=0 \\
& \text { So } x=8 \text { or }-10 \text { both are even }
\end{aligned}
$$

There are two sets of answers.
Numbers could be 8 and 10 or -10 and - 8
5. A display rocket is fired vertically upwards. Its height $h$, at $t$ secs is $h=60 t-5 t^{2}$.
The rocket explodes when it reaches a height of 160 metres.
Find the time when it explodes.
(why do you get 2 answers?)

$$
\begin{aligned}
60 t-5 t^{2} & =160 \\
\text { So } \quad 0 & =5 t^{2}-60 t+160 \\
0 & =5\left(t^{2}-12 t+32\right) \\
0 & =5(t-4)(t-8)
\end{aligned}
$$

So $t$ could be 4 or 8
The answer is $t=4$ sec when it $1^{\text {st }}$ reaches $a$ height of 160 m .
If it did not explode it would be at 160 m again on the way down at 8 sec.
6. A special bomb is designed to explode when a pressure device inside it reaches 240 Pascals. The pressure $P$, at $t$ secs after the pin is pulled is given by $\mathrm{P}=100 \mathrm{t}-10 \mathrm{t}^{2}$.
(a) Find P when $\mathrm{t}=1 \mathrm{sec}$
(b) Find P when $\mathrm{t}=2 \mathrm{sec}$
(c) At what time will P reach 240 Pa ?
7. The temperature ( T ) in a laboratory heater at t minutes from turning it on, is given by: $\mathrm{T}=20+8 \mathrm{t}-\mathrm{t}^{2}$
(a) Find the temperature at the instant it is turned on at $\mathrm{t}=0 \mathrm{sec}$.
$T=20^{\circ} \mathrm{C}$
(b) Find T at $\mathrm{t}=1 \mathrm{~min}$.
$T=20+8-1=27^{\circ} \mathrm{C}$
(c) A certain bacterial culture has to be removed the instant the temperature reaches $35^{\circ} \mathrm{C}$. Find at what time this will be.

$$
\begin{aligned}
20+8 t-t^{2} & =35 \\
0 & =t^{2}-8 t+15 \\
0 & =(t-3)(t-5)
\end{aligned}
$$

So $t=3$ or 5
The temp $1^{\text {st }}$ reaches $35^{0} \mathrm{C}$ at $t=3 \mathrm{~min}$
8. A rectangular room has an area of $42 \mathrm{~m}^{2}$. When a square carpet is put in one corner, the width of the strips of floor left uncovered are 1 m and 2 m .
(a) Draw a diagram and use $\boldsymbol{x}$ to represent the length of each side of the carpet.

(b) Find the area of the carpet square.

$$
\begin{aligned}
\text { Area }=(x+1)(x+2) & =42 \\
\text { So } x^{2}+3 x+2 & =42 \\
x^{2}+3 x-40 & =0 \\
(x-5)(x+8) & =0
\end{aligned}
$$

So $x=5$ or -8 but this is not valid
So area of carpet $=25 \mathrm{~m}^{2}$
9. An area can be covered by 100 square tiles of side " $x$ " cm .
(a) What is the area in terms of $\boldsymbol{x}$ ?


$$
\text { Area }=100 x^{2}
$$

(b) A smaller tile is used which has each side 10 cm smaller than the other tiles. What is the area of each smaller tile in terms of " $x$ " ?
$x-10 \square^{x-10}$ Area $=(x-10)^{2}$
(c) If it takes 400 of the smaller tiles to cover the same area as 100 of the larger tiles, find the size of each type of tile and the total area to be covered.

$$
\begin{aligned}
& 400(x-10)^{2}=100 x^{2} \\
& 4(x-10)^{2}=x^{2} \\
& 4\left(x^{2}-20 x+100\right)=x^{2} \\
& 4 x^{2}-80 x+400=x^{2} \\
& 3 x^{2}-80 x+400=0 \\
&(3 x-20)(x-20)=0 \\
& \text { So } x=6.67 \text { or } 20
\end{aligned}
$$

If the larger tile is 6.67 the smaller one can't be 10 less!
The large tile has sides of 20 cm and the small tile has sides of 10 cm .
The total area $=100 \times 20^{2}$ or $400 \times 10^{2}$ which is $40,000 \mathrm{~cm}^{2}$

