GCSE (1 – 9)
Rearranging Harder Formula

Instructions

• Use black ink or ball-point pen.
• Answer all questions.
• Answer the questions in the spaces provided
  – there may be more space than you need.
• Diagrams are NOT accurately drawn, unless otherwise indicated.
• You must show all your working out.

Information

• The marks for each question are shown in brackets
  – use this as a guide as to how much time to spend on each question.

Advice

• Read each question carefully before you start to answer it.
• Keep an eye on the time.
• Try to answer every question.
• Check your answers if you have time at the end
1 Make $u$ the subject of the formula $v = u + at$

$$v - at = u$$

$$u = v - at$$

(Total for question 1 is 1 mark)

2 Make $a$ the subject of the formula $v = u + at$

$$v - u = at$$

$$a = \frac{v - u}{t}$$

$$a = \frac{v - u}{t}$$

(Total for question 2 is 2 marks)
3  Make \( u \) the subject of the formula \( v^2 = u^2 + 2as \)

\[
\begin{align*}
-2as + -2as &
\end{align*}
\]

\[
\begin{align*}
v^2 - 2as &= u^2 \\
\sqrt{v^2 - 2as} &= u
\end{align*}
\]

\[
\begin{align*}
u &= \sqrt{v^2 - 2as}
\end{align*}
\]

(Total for question 3 is 2 marks)

4  Make \( a \) the subject of the formula \( v^2 = u^2 + 2as \)

\[
\begin{align*}
-2s + -2s &
\end{align*}
\]

\[
\begin{align*}
v^2 - u^2 &= 2as \\
\frac{v^2 - u^2}{2s} &= \frac{2as}{2s}
\end{align*}
\]

\[
\begin{align*}
a &= \frac{v^2 - u^2}{2s}
\end{align*}
\]

(Total for question 4 is 2 marks)
5 Make \( a \) the subject of the formula \( s = ut + \frac{1}{2}at^2 \)

\[
\begin{align*}
-ut & \quad -ut \\
S - ut &= \frac{1}{2}at^2 \\
2(S - ut) &= at^2 \\
a &= \frac{2(S - ut)}{t^2}
\end{align*}
\]

\[
a = \frac{2(S - ut)}{t^2}
\]

(Total for question 5 is 2 marks)

6 Make \( v \) the subject of the formula \( T = \frac{1}{2}mv^2 \)

\[
\begin{align*}
2T &= mv^2 \\
\frac{2T}{m} &= v^2 \\
\sqrt{\frac{2T}{m}} &= v
\end{align*}
\]

\[
v = \sqrt{\frac{2T}{m}}
\]

(Total for question 6 is 2 marks)
7 Make \( x \) the subject of the formula \( 2x + a = b(x - 2) \)

\[
\begin{align*}
2x + a &= bx - 2b \\
-2x &= -2x \\
a &= bx - 2x - 2b + 2b \\
a + 2b &= bx - 2x \\
a + 2b &= x(b - 2) \\
x &= \frac{a + 2b}{b - 2}
\end{align*}
\]

\[
\text{or } x = \frac{-2b - a}{2 - b}
\]

\[
\text{x} = \frac{a + 2b}{b - 2}
\]

(Total for question 7 is 3 marks)

8 Make \( x \) the subject of the formula \( x(2 + a) = b(x + 3) \)

\[
\begin{align*}
2x + ax &= bx + 3b \\
-6x &= -6x \\
2x + ax - bx &= 3b \\
x(2 + a - b) &= 3b \\
x &\quad = \frac{3b}{2 + a - b}
\end{align*}
\]

\[
\text{or } x = \frac{-3b}{b - a - 2}
\]

\[
\text{x} = \frac{3b}{2 + a - b}
\]

(Total for question 8 is 3 marks)
9 Make \( x \) the subject of the formula \( a = \frac{x+4}{x+2} \)

\[
\begin{align*}
\alpha (x+2) &= x + 4 \\
\alpha x + 2\alpha &= x + 4 \\
-x &= -x \\
\alpha x - x + 2\alpha &= 4 - 2\alpha \\
\alpha x - x &= 4 - 2\alpha \\
x(a - 1) &= 4 - 2\alpha \\
x &= \frac{4 - 2\alpha}{a-1} \\
\text{or } x &= \frac{2\alpha - 4}{1 - \alpha}
\end{align*}
\]

(Total for question 9 is 3 marks)

10 Make \( x \) the subject of the formula \( a = \frac{x+c}{x-b} \)

\[
\begin{align*}
\alpha (x-b) &= x + c \\
\alpha x - \alpha b &= x + c \\
-x &= -x \\
\alpha x - x - \alpha b &= c + \alpha b \\
\alpha x - x &= c + \alpha b \\
x(a - 1) &= c + \alpha b \\
x &= \frac{c + \alpha b}{a-1} \\
x &= \frac{-c - \alpha b}{1 - \alpha}
\end{align*}
\]

(Total for question 10 is 3 marks)
11. Make $x$ the subject of the formula $\frac{a}{b} = \frac{2x}{x+5}$

\[
\begin{align*}
    a(x+5) &= 2x(b) \\
    ax + 5a &= 2bx \\
    5a &= 2bx - ax \\
    5a &= x(2b-a) \\
    x &= \frac{5a}{2b-a}
\end{align*}
\]

or $x = \frac{-5a}{a-2b}$

(Total for question 11 is 3 marks)

12. Make $x$ the subject of the formula $a = \frac{4+2bx}{2x-3}$

\[
\begin{align*}
    a(2x-3) &= 4 + 2bx \\
    2ax - 3a &= 4 + 2bx \\
    2ax - 2bx - 3a &= 4 \\
    2ax - 2bx &= 4 + 3a \\
    x(2a-2b) &= 4 + 3a \\
    x &= \frac{4 + 3a}{2a-2b}
\end{align*}
\]

or $x = \frac{-3a-4}{2b-2a}$

(Total for question 12 is 3 marks)
13 Make $b$ the subject of the formula \( \frac{1}{a} = \frac{1}{b} + \frac{1}{c} \)

\[
1 = \frac{a}{b} + \frac{a}{c} \quad (\times a)
\]

\[
b = a + \frac{ab}{c} \quad (\times b)
\]

\[
bc = ac + ab \quad (\times c)
\]

\[
bc - ab = ac
\]

\[
b(c-a) = ac
\]

\[
b = \frac{ac}{c-a}
\]

or \( b = \frac{-ac}{a-c} \)