∑ DANEMATHICS
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GRADE 10 · EXPONENTS, EQUATIONS AND INEQUALITIES

Literal Equations: Changing the Subject of a Formula

MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
33	50 minutes	3

Name: ..... Class: .....

Date: .....

MARK ____ / 33

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 Make x the subject of $y = mx + c$. (1)

A) $\frac{y-c}{m}$ ✓

B) $\frac{y}{m} - c$

C) $y - c - m$

D) $\frac{y+c}{m}$

Answer: A — Subtract c from both sides first, then divide the WHOLE side by m.

- **B** — divided only the y by m — the c must be moved across first
- **C** — subtracted m instead of dividing by it
- **D** — added c instead of subtracting it

1.2 Make r the subject of $A = \pi r^2$. (1)

A) $A \div \pi$

B) $\sqrt{A\pi}$

C) $A^2 \div \pi$

D) $\sqrt{A \div \pi}$ ✓

Answer: D — Divide both sides by π to get $r^2 = \frac{A}{\pi}$, then take the square root.

- **A** — stopped at r^2 and never took the square root
- **B** — multiplied by π instead of dividing by it
- **C** — squared A instead of square-rooting after dividing

1.3 Make h the subject of $V = \frac{1}{3}\pi r^2 h$. (1)

A) $\frac{3V}{\pi r}$

B) $\frac{3V}{\pi r^2}$ ✓

C) $\frac{V}{3\pi r^2}$

D) $\frac{V}{\pi r^2}$

Answer: B — Multiply both sides by 3 to clear the third, then divide by πr^2.

- **A** — dropped the square on the r
- **C** — divided by 3 instead of multiplying — the $\frac{1}{3}$ is on the other side
- **D** — never cleared the $\frac{1}{3}$ at all

1.4 Make b the subject of $P = 2(l + b)$. (1)

A) $\frac{P}{2l}$

B) $P - 2l$

C) $\frac{P - 2l}{2}$ ✓

D) $\frac{P}{2} - 2l$

Answer: C — Divide both sides by 2 to get $l + b = \frac{P}{2}$, then subtract l — which is $\frac{P - 2l}{2}$.

- **A** — divided by $2l$ instead of subtracting l
- **B** — never divided by the 2 at all
- **D** — divided the P by 2 but not the $2l$

1.5 Make x the subject of $ax + b = cx + d$. (1)

A) $\frac{d - b}{a - c}$ ✓

B) $\frac{b - d}{a - c}$

C) $\frac{d - b}{c - a}$

D) $\frac{d + b}{a + c}$

Answer: A — Collect the x terms: $ax - cx = d - b$, so $x(a - c) = d - b$.

- **B** — moved b across without changing its sign
- **C** — swapped a and c when factorising
- **D** — added the terms instead of moving them across, which changes their signs

1.6 Make a the subject of $v^2 = u^2 + 2as$. (1)

A) $\frac{v - u}{2s}$

B) $\frac{v^2 + u^2}{2s}$

C) $\frac{v^2 - u^2}{s}$

D) $\frac{v^2 - u^2}{2s}$ ✓

Answer: D — Subtract u^2 from both sides, then divide by $2s$.

- **A** — square-rooted v^2 and u^2 separately, which cannot be done across a subtraction
- **B** — added u^2 instead of subtracting it
- **C** — forgot to divide by the 2 as well as the s

1.7 Make C the subject of $F = \frac{9}{5}C + 32$. (1)

A) $\frac{5}{9}F - 32$

B) $\frac{5}{9}(F + 32)$

C) $\frac{9}{5}(F - 32)$

D) $\frac{5}{9}(F - 32)$ ✓

Answer: D — Subtract 32 first, then multiply by the reciprocal $\frac{5}{9}$.

- **A** — multiplied only the F by $\frac{5}{9}$ — the whole side must be multiplied
- **B** — added 32 instead of subtracting it
- **C** — multiplied by $\frac{9}{5}$ again instead of by its reciprocal

1.8 Make n the subject of $T_n = a + (n - 1)d$. (1)

A) $\frac{T_n + a}{d} + 1$

B) $\frac{T_n - a}{d} + 1$ ✓

C) $\frac{T_n - a}{d}$

D) $\frac{T_n - a + 1}{d}$

Answer: B — Subtract a, divide by d to reach $n - 1$, then add 1.

- **A** — added a instead of subtracting it
- **C** — stopped at $n - 1$ and never added the 1
- **D** — added the 1 inside the fraction instead of after dividing

1.9 Make x the subject of $\frac{x}{a} + \frac{x}{b} = 1$. (1)

A) $\frac{a + b}{ab}$

B) ab

C) $\frac{ab}{a + b}$ ✓

D) $\frac{ab}{a - b}$

Answer: C — The left side is $\frac{x(a + b)}{ab}$, so $x = \frac{ab}{a + b}$.

- **A** — inverted the fraction at the last step
- **B** — multiplied by ab but forgot to divide by $(a + b)$
- **D** — subtracted the denominators instead of adding them when forming the LCD

1.10 Make y the subject of $3x - 2y = 12$. (1)

A) $\frac{12 - 3x}{2}$

B) $\frac{3x - 12}{2}$ ✓

C) $3x - 12$

D) $\frac{3x + 12}{2}$

Answer: B — $-2y = 12 - 3x$, and dividing by -2 flips both signs to give $\frac{3x - 12}{2}$.

- **A** — divided by $+2$ instead of -2, so both signs came out the wrong way round
- **C** — forgot to divide by the 2
- **D** — moved the $3x$ across without changing its sign

ANSWER GRID — MARKING GUIDELINE

1.1	**A**	B	C	D
1.2	A	B	C	**D**
1.3	A	**B**	C	D
1.4	A	B	**C**	D
1.5	**A**	B	C	D
1.6	A	B	C	**D**
1.7	A	B	C	**D**
1.8	A	**B**	C	D
1.9	A	B	**C**	D
1.10	A	**B**	C	D

QUESTION 2 [12 MARKS]

Change the subject of each formula as instructed. Show ALL your steps.

2.1 Make x the subject of $y = 2x + 6$. **(3)**

$y - 6 = 2x$ *(1)*

$x = \frac{y - 6}{2}$ *(2)*

2.2 Make r the subject of $V = \pi r^2 h$, and hence calculate r if $V = 500$, $h = 10$ and $\pi \approx 3{,}14$, correct to TWO decimal places. **(5)**

$r^2 = \frac{V}{\pi h}$ *(1)*

$r = \sqrt{\frac{V}{\pi h}}$ *(2)*

$r = \sqrt{\frac{500}{31{,}4}}$ *(1)* $= \mathbf{3{,}99}$ *(1)*

2.3 Make x the subject of $ax = bx + c$. **(4)**

$ax - bx = c$ *(1)*

$x(a - b) = c$ *(2)*

$x = \frac{c}{a - b}$, $a \neq b$ *(1)*

QUESTION 3 [11 MARKS]

Answer the questions below.

3.1 Make n the subject of $A = P(1 + in)$. **(4)**

$\frac{A}{P} = 1 + in$ *(1)*

$in = \frac{A}{P} - 1$ *(1)*

$n = \frac{\frac{A}{P} - 1}{i}$ *(2)*

3.2 Hence determine how many years it takes R1 000 to grow to R1 400 at 10% p.a. simple interest. **(4)**

> $\frac{1\ 400}{1\ 000} = 1{,}4$ *(1)*
>
> $n = \frac{0{,}4}{0{,}1}$ *(2)* $=$ **4 years** *(1)*

3.3 Explain, in words, the method used when the required letter appears TWICE. **(3)**

> Collect every term containing that letter on one side *(1)*, factorise the letter out *(1)*, then divide by the bracket *(1)*

TOTAL: 33 marks

This question paper consists of 3 questions.

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