HKDSE Section A(1) analysis

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Introduction

Chapter 1

Index Law

The problems of index laws requires the following knowledge:

Given a, b be real numbers and m, n be positive integers. Then

1. $a^m \cdot a^n = a^{m+n}$.
2. $\frac{a^m}{a^n} = a^{m-n}$.
3. $(a^m)^n = a^{mn}$.
4. $a^0 = 1$.
5. $a^{-n} = \frac{1}{a^n}$.
6. $(ab)^n = a^n b^n$.
7. $(\frac{a}{b})^n = \frac{a^n}{b^n}$.

Example (2012-PAPER-1 Q1)**.** *Simplify* $\dfrac{m^{-12}n^8}{n^3}$ *and express your answer with positive indices.*

Solution.

Following the law of index, we deduce

$$\begin{aligned} \frac{m^{-12}n^8}{n^3} &= m^{-12}n^{8-3} && (by\,2) \\ &= m^{-12}n^5 \\ &= \frac{n^5}{m^{12}} && (by\,5) \end{aligned}$$

As the problem requires positive indices, we have to apply the fifth law to remove all negative powers. *. . . end of solution.*

Chapter 2

Subject arrangement

Subject arrangement is one of the pure algebraic action. Its concept of arrangement is similar to solving equations with one variable.

Let's consider Solving $4x + 2 = 6x - 3$. We have

$$\begin{aligned} 4x + 2 &= 6x - 3 \\ 4x + 2 - 2 &= 6x - 3 - 2 \\ 4x &= 6x - 5 \\ 4x - 6x &= 6x - 5 - 6x \\ -2x &= -5 \\ x &= \frac{-5}{-2} \\ &= \frac{5}{2} \end{aligned}$$

Of the same course, we could solve $4x + k = 6x + \ell$ by the same procedure:

$$\begin{aligned} 4x + k &= 6x + \ell \\ -2x &= \ell - k \\ x &= \frac{k - \ell}{2} \end{aligned}$$

Therefore, we could solve for even more variables:

$$\begin{aligned} ax + k &= bx + \ell \\ (a - b)x &= \ell - k \\ x &= \frac{\ell - k}{a - b} \end{aligned}$$

This is called making x to be the subject of an equation, where making subject is equivalent to solving equation by seeing the required variable as the only unknown.

Example (2012-PAPER-1 Q1)**.** *Make a the subject of the formula* $\dfrac{3a+b}{8} = b - 1$.

Solution.

To make a the subject of the formula, we see a as the only variable of the equation.

$$\begin{aligned}
\frac{3a+b}{8} &= b - 1 \\
3a + b &= 8b - 8 && (\textit{multiply both sides by } 8) \\
3a &= 7b - 8 && (\textit{isolate } a) \\
a &= \frac{7b-8}{3} && (\textit{divide sides by } 3)
\end{aligned}$$

. . . end of solution.

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