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Chapter 8 Problem Solving - Set B:

Bronze:

a) $(1-5x)^4 \rightarrow 1^4 + \binom{4}{1}(1)^3(-5x) + \binom{4}{2}(1)^2(-5x)^2$

$= \underline{1 - 20x + 150x^2}$

b) $(2+kx)(1-20x+150x^2)$

$2 - 40x + 300x^2 + kx - 20kx^2 + \underline{150kx^3}$ ↳ ignore this term

$\underline{2}$ ↓ $\underline{A}$ $\therefore A = 2$

c) $-40x + kx = -37x$

$-40 + k = -37$

$\underline{k = 3}$

d) $2 - 40x + 300x^2 + 3x - 20(3)x^2 + 150(3)x^3$

$2 - 37x + 300x^2 - 60x^2 + \underline{450x^3}$ ↳ ignore term

$\rightarrow 2 - 37x + \underline{240x^2}$ $\therefore B = \underline{240}$

↓ B

Silver:

$(2-5x)^4 \rightarrow 2^4 + \binom{4}{1}(2)^3(-5x) + \binom{4}{2}(2)^2(-5x)^2$

$= 16 - 160x + 600x^2$ (ignoring larger powers)

$(1+kx)(16-160x+600x^2)$

↳ $16 - 160x + 600x^2 + 16kx - 160kx^2 + \underline{600kx^3}$ ↳ ignore term

$-160x + 16kx = -64x$

$-160 + 16k = -64$

$16k = 96$

$\underline{k = 6}$ → sub into equation

→ $16 - 160x + 600x^2 + 16(6)x - 160(6)x^2$

$16 - 64x - 360x^2$

$\therefore \underline{A = 16}$

$\underline{B = -360}$

$\underline{k = 6}$

Gold

a) $(3+px)(1+qx)^5$

$3 + 17x + {}^{70}/_{3}x^2 + kx^3$

① $3 \times \binom{5}{1}(1)^4(qx) + 1(px) = 17x$

$15qx + px = 17x$

$15q + p = 17 \rightarrow p = 17 - 15q$ (sub into ②)

② $3 \times \binom{5}{2}(1)^3(qx)^2 + px\binom{5}{1}(1)^4(qx)$

$30q^2x^2 + 5pqx^2 = {}^{70}/_{3}x^2$

$30q^2 + 5pq = {}^{70}/_{3}$

$\rightarrow 30q^2 + 5q(17 - 15q) = {}^{70}/_{3}$

$30q^2 + 85q - 75q^2 = {}^{70}/_{3}$

$-45q^2 + 85q = {}^{70}/_{3}$ $(\times 3)$

$-135q^2 + 255q - 70 = 0$ OR $135q^2 - 255q + 70 = 0$

using quadratic formula: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ where $a = 135$, $b = -255$, $c = 70$

$q = {}^{14}/_{9}$ or $q = {}^{1}/_{3}$

when $q = {}^{14}/_{9}$

$p = 17 - 15({}^{14}/_{9}) = -{}^{57}/_{9}$ $\therefore q \neq {}^{14}/_{9}$

when $q = {}^{1}/_{3}$

$p = 17 - 15({}^{1}/_{3}) = 12$

Therefore $p = 12$, $q = {}^{1}/_{3}$

b) ① $\binom{5}{3}(1)^2(qx)^3 \rightarrow 10q^3x^3 \rightarrow 3(10q^3x^3) \rightarrow 30q^3x^3$

② $\binom{5}{2}(1)^3(qx)^2 \rightarrow 10q^2x^2$

$px(10q^2x^2) \rightarrow 10pq^2x^3$

$30q^3 + 10pq^2 = kx^3$

$30q^3 + 10pq^2 = k$ $\rightarrow$ sub $q = {}^{1}/_{3}$ and $p = 12$

$k = 30({}^{1}/_{3})^3 + 10(12)({}^{1}/_{3})^2$

$k = {}^{130}/_{9}$