

- 1 Find the coefficient of x^2 in the expansion of

$$\begin{aligned} (1+3x)^{10} &= 1^{10} + 10 \times 1^9 \times (3x) + 45 \times 1^8 \times (3x)^2 + \dots \\ &= 1 + 30x + 45 \times 9x^2 + \dots \\ &= 1 + 30x + 405x^2 + \dots \end{aligned}$$

$$(2-5x)(1+30x+405x^2+\dots)$$

$$\begin{aligned} \text{coeff of } x^2: & 2 \times 405x^2 + -5x \times 30x \\ &= 810x^2 - 150x^2 \\ &= 660x^2 \end{aligned}$$

$$\text{coeff} = \underline{\underline{660}}$$

- 1 The coefficient of x^2 in the expansion of $(1-4x)^6$ is 12 times the coefficient of x^2 in the expansion of $(2+ax)^5$.

Find the value of the positive constant a .

[3]

$$\begin{aligned}(1-4x)^6 &= 1^6 + 6 \times 1^5 \times (-4x) + 15 \times 1^4 \times (-4x)^2 + \dots \\ &= 1 - 24x + \underline{240x^2} + \dots\end{aligned}$$

$$\text{coeff of } x^2 = 240$$

$$\begin{aligned}(2+ax)^5 &= 2^5 + 5 \times 2^4 \times (ax) + 10 \times 2^3 \times (ax)^2 + \dots \\ &= 32 + 80ax + 80a^2x^2 + \dots\end{aligned}$$

$$\text{coeff of } x^2 = 80a^2$$

$$240 = 12 \times 80a^2$$

$$240 = 960a^2$$

$$a^2 = \frac{1}{4}$$

$$a = \pm \frac{1}{2}$$

$$a \text{ is positive: } \underline{\underline{a = \frac{1}{2}}}$$

- 4 (a) Expand $(1 + a)^5$ in ascending powers of a up to and including the term in a^3 . [1]

$$(1 + a)^5 = 1^5 + 5 \times 1^4 \times a + 10 \times 1^3 \times a^2 + 10 \times 1^2 \times a^3 + \dots$$

$$= \underline{1 + 5a + 10a^2 + 10a^3 + \dots}$$

- (b) Hence expand $[1 + (x + x^2)]^5$ in ascending powers of x up to and including the term in x^3 , simplifying your answer. [3]

replace a with $(x + x^2)$:

$$1 + 5(x + x^2) + 10(x + x^2)^2 + 10(x + x^2)^3 + \dots$$

$$= 1 + 5x + 5x^2 + 10(x^2 + 2x^3 + x^6) + 10(x + x^2)(x^2 + 2x^3 + x^6)$$

$$= 1 + 5x + 5x^2 + 10x^2 + 20x^3 + \cancel{10x^6} + 10x^3 + \dots$$

$$= \underline{1 + 5x + 15x^2 + 30x^3 + \dots}$$

- 1 The coefficient of x^4 in the expansion of $(3+x)^5$ is equal to the coefficient of x^2 in the expansion of $\left(2x + \frac{a}{x}\right)^6$.

Find the value of the positive constant a.

[4]

$$(3+x)^5 = 3^5 + 5 \times 3^4 \times x + 10 \times 3^3 \times x^2 + 10 \times 3^2 \times x^3 + \dots + \underline{5 \times 3 \times x^4} + x^5$$

$$\rightarrow \text{coeff} = 15$$

$$\left(2x + \frac{a}{x}\right)^6 = (2x)^6 + 6(2x)^5\left(\frac{a}{x}\right) + \underline{15(2x)^4\left(\frac{a}{x}\right)^2} + \dots$$

$$\rightarrow 15 \times 16x^4 \times \frac{a^2}{x^2}$$

$$= 240a^2x^2$$

$$\text{coeff} = 240a^2$$

$$240a^2 = 15$$

$$a^2 = \frac{1}{16}$$

$$a = \pm \frac{1}{4}$$

$$a \text{ is positive, so } \underline{\underline{a = \frac{1}{4}}}$$



- 3 (a) Find the coefficients of x^3 and x^4 in the expansion of $(3-ax)^5$, where a is a constant. Give your answers in terms of a . [3]

$$(3-ax)^5 = 3^5 + 5 \times (3)^4(-ax) + 10 \times (3)^3(-ax)^2 + 10 \times (3)^2(-ax)^3 + 5 \times 3 \times (-ax)^4 + (-ax)^5$$

$$\begin{aligned} \underline{x^3}: \quad & 10 \times (3)^2(-ax)^3 \\ & = 10 \times 9 \times -a^3x^3 \\ & = -90a^3x^3 \end{aligned}$$

$$\text{coeff: } = \underline{-90a^3}$$

$$\begin{aligned} \underline{x^4}: \quad & 5 \times 3 \times (-ax)^4 \\ & = 15 \times a^4x^4 \\ & = 15a^4x^4 \end{aligned}$$

$$\text{coeff: } = \underline{15a^4}$$

- (b) Given that the coefficient of x^4 in the expansion of $(ax+7)(3-ax)^5$ is 240, find the positive value of a . [3]

$$(ax+7)(-90a^3x^3 + 15a^4x^4)$$

$$\begin{aligned} & = -90a^4x^4 + 105a^4x^4 \\ & = 15a^4x^4 \end{aligned}$$

$$\text{coeff} = 240: \quad 15a^4 = 240$$

$$a^4 = 16$$

$$a = \pm 2$$

we want positive value:

$$\underline{a = 2}$$



- 1 The coefficient of x^3 in the expansion of $(1+kx)(1-2x)^5$ is 20.

Find the value of the constant k .

[4]

$$\begin{aligned}(1-2x)^5 &= 1^5 + 5 \times 1^4 \times (-2x) + 10 \times 1^3 \times (-2x)^2 + 10 \times 1^2 \times (-2x)^3 + \dots \\ &= 1 - 10x + 10 \times 4x^2 + 10 \times -8x^3 + \dots \\ &= 1 - 10x + 40x^2 - 80x^3 + \dots\end{aligned}$$

$$\rightarrow (1+kx)(1-10x+40x^2-80x^3+\dots)$$

$$\text{coeff of } x^3: -80x^3 + 40kx^3$$

$$(40k-80)x^3$$

$$\text{coeff} = 40k - 80$$

$$40k - 80 = 20$$

$$40k = 100$$

$$k = \frac{5}{2}$$

- 6 It is given that the coefficient of x^3 in the expansion of

$$(2+ax)^4(5-ax)$$

is 432.

Find the value of the constant a .

$$\begin{aligned} (2+ax)^4 &= 2^4 + 4 \times 2^3(ax) + 6 \times 2^2(ax)^2 + 4 \times 2(ax)^3 + \dots \\ &= 16 + 32ax + 24a^2x^2 + 8a^3x^3 + \dots \end{aligned}$$

$$(2+ax)^4(5-ax):$$

$$(16 + 32ax + 24a^2x^2 + 8a^3x^3)(5 - ax)$$

x^3 term:

$$\begin{aligned} &- 24a^3x^3 + 40a^3x^3 \\ &= 16a^3x^3 \end{aligned}$$

coeff of x^3 : $16a^3$

$$16a^3 = 432$$

$$a^3 = 27$$

$$\underline{a = 3}$$

- 1 The coefficient of x^3 in the expansion of $(3 + 2ax)^5$ is six times the coefficient of x^2 in the expansion of $(2 + ax)^6$.

Find the value of the constant a .

[4]

$$(3 + 2ax)^5 = 3^5 + 5 \times 3^4 \times (2ax) + 10 \times 3^3 \times (2ax)^2 + 10 \times 3^2 \times (2ax)^3 + \dots$$

$$= 243 + 405 \times 2ax + 270 \times 4a^2x^2 + 90 \times 8a^3x^3 + \dots$$

$$= 243 + 910ax + 1080a^2x^2 + 720a^3x^3 + \dots$$

coefficient of x^3 : $720a^3$

$$(2 + ax)^6 = 2^6 + 6 \times 2^5 \times (ax) + 15 \times 2^4 \times (ax)^2 + \dots$$

$$= 64 + 192ax + 240 \times (ax)^2 + \dots$$

$$= 64 + 192ax + 240a^2x^2 + \dots$$

coefficient of x^2 : $240a^2$

coeff of $x^3 = 6 \times$ coeff of x^2 :

$$720a^3 = 6 \times 240a^2$$

$$720a^3 = 1440a^2 \quad \div 720$$

$$a^3 = 2a^2$$

$$a^3 - 2a^2 = 0$$

$$a^2(a - 2) = 0$$

$$a = 0 \quad \text{or} \quad \underline{a = 2}$$

x

✓

- 1 In the expansion of $\left(kx + \frac{2}{x}\right)^4$, where k is a positive constant, the term independent of x is equal to 150.

Find the value of k and hence determine the coefficient of x^2 in the expansion. [4]

$$\left(kx + \frac{2}{x}\right)^4 = \left(kx\right)^4 + 4\left(kx\right)^3 \times \left(\frac{2}{x}\right) + 6\left(kx\right)^2 \times \left(\frac{2}{x}\right)^2 + 4\left(kx\right) \times \left(\frac{2}{x}\right)^3 + \left(\frac{2}{x}\right)^4$$

$$\rightarrow 6\left(kx\right)^2 \times \left(\frac{2}{x}\right)^2 = 6 \times k^2 \cancel{x^2} \times \frac{4}{\cancel{x^2}} = 24k^2$$

equal to 150:

$$24k^2 = 150$$

$$k^2 = \frac{25}{4}$$

$$k = \pm \sqrt{\frac{25}{4}}$$

$$= \pm \frac{5}{2}$$

k is positive, so $\underline{k = \frac{5}{2}}$

* Coefficient of x^2 :

$$4\left(kx\right)^3 \times \left(\frac{2}{x}\right) = 4\left(\frac{5}{2}x\right)^3 \times \left(\frac{2}{x}\right)$$

$\hookrightarrow k = \frac{5}{2}$

$$= 4 \times \frac{125}{8} x^3 \times \frac{2}{x}$$

$$= 125x^2$$

coefficient only = 125



- 7 (a) Write down the first four terms of the expansion, in ascending powers of x , of $(a-x)^6$. [2]

$$(a-x)^6 = a^6 + 6 \times a^5(-x) + 15 \times a^4(-x)^2 + 20 \times a^3(-x)^3 + \dots$$

$$= \underline{a^6 - 6a^5x + 15a^4x^2 - 20a^3x^3 + \dots}$$

- (b) Given that the coefficient of x^2 in the expansion of $\left(1 + \frac{2}{ax}\right)(a-x)^6$ is -20 , find in exact form the possible values of the constant a . [5]

$$\left(1 + \frac{2}{ax}\right)(a^6 - 6a^5x + 15a^4x^2 - 20a^3x^3)$$

$$= 15a^4x^2 + \frac{2}{ax}x - 20a^3x^3$$

$$= 15a^4x^2 - 40a^2x^2$$

$$\text{coeff} = 15a^4 - 40a^2$$

$$15a^4 - 40a^2 = -20$$

$$15a^4 - 40a^2 + 20 = 0$$

$$3a^4 - 8a^2 + 4 = 0$$

$$\text{Let } X = a^2: 3X^2 - 8X + 4 = 0$$

$$(3X-2)(X-2) = 0$$

$$3X-2=0 \quad X-2=0$$

$$X = \frac{2}{3}$$

$$X = 2$$

$$a^2 = \frac{2}{3}$$

$$a^2 = 2$$

$$\underline{a = \pm\sqrt{\frac{2}{3}}} \quad \text{or} \quad \underline{a = \pm\sqrt{2}}$$

- 1 (a) Expand $\left(1 - \frac{1}{2x}\right)^2$. [1]

$$\begin{aligned} \left(1 - \frac{1}{2x}\right)\left(1 - \frac{1}{2x}\right) &= 1 - \frac{1}{2x} - \frac{1}{2x} + \left(\frac{1}{2x}\right)^2 \\ &= 1 - \frac{2}{2x} + \frac{1}{4x^2} \\ &= 1 - \frac{1}{x} + \frac{1}{4x^2} \end{aligned}$$

- (b) Find the first four terms in the expansion, in ascending powers of x , of $(1 + 2x)^6$. [2]

$$\begin{aligned} (1 + 2x)^6 &= 1^6 + 6 \times 1^5 \times (2x) + 15 \times 1^4 \times (2x)^2 + 20 \times 1^3 \times (2x)^3 + \dots \\ &= 1 + 6 \times 2x + 15 \times 4x^2 + 20 \times 8x^3 + \dots \\ &= 1 + 12x + 60x^2 + 160x^3 + \dots \end{aligned}$$

- (c) Hence find the coefficient of x in the expansion of $\left(1 - \frac{1}{2x}\right)^2 (1 + 2x)^6$. [2]

$$\left(1 - \frac{1}{2x} + \frac{1}{4x^2}\right)(1 + 12x + 60x^2 + 160x^3 + \dots)$$

coeff of x : $12x - \frac{1}{2x} \times 60x^2 + \frac{1}{4x^2} \times 160x^3$

$$= 12x - 60x + 40x$$

$$= -8x$$

coeff = -8

- 3 (a) Give the complete expansion of $\left(x + \frac{2}{x}\right)^5$. [2]

$$\begin{aligned} \left(x + \frac{2}{x}\right)^5 &= x^5 + 5x^4\left(\frac{2}{x}\right) + 10x^3\left(\frac{2}{x}\right)^2 + 10x^2\left(\frac{2}{x}\right)^3 \\ &\quad + 5x\left(\frac{2}{x}\right)^4 + \left(\frac{2}{x}\right)^5 \\ &= x^5 + 10x^4 \times \frac{1}{x} + 40 \times x^3 \times \frac{1}{x^2} + 80 \times x^2 \times \frac{1}{x^3} \\ &\quad + 80x \times \frac{1}{x^4} + 32 \times \frac{1}{x^5} \\ &= x^5 + 10x^3 + 40x + \frac{80}{x} + \frac{80}{x^3} + \frac{32}{x^5} \end{aligned}$$

- (b) In the expansion of $(a + bx^2)\left(x + \frac{2}{x}\right)^5$, the coefficient of x is zero and the coefficient of $\frac{1}{x}$ is 80.

Find the values of the constants a and b .

[4]

$$\rightarrow (a + bx^2)\left(x^5 + 10x^3 + 40x + \frac{80}{x} + \frac{80}{x^3} + \frac{32}{x^5}\right)$$

$$\text{coefficient of } x=0: a \times 40x + bx^2 \times \frac{80}{x} = 0$$

$$40ax + 80bx = 0$$

$$\text{coeff: } 40a + 80b = 0$$

$$a + 2b = 0 \quad (1)$$

$$\text{coefficient of } \frac{1}{x} = 80: a \times \frac{80}{x} + bx^2 \times \frac{80}{x^3} = 80$$

$$80a \times \frac{1}{x} + 80b \times \frac{1}{x} = 80$$

$$\text{coeff: } 80a + 80b = 80$$

$$a + b = 1 \quad (2)$$

$$(1) - (2): \underline{b = -1} \rightarrow (2): a + -1 = 1$$

$$\underline{a = 2}$$

- 6 The coefficient of $\frac{1}{x}$ in the expansion of $\left(2x + \frac{a}{x^2}\right)^5$ is 720.

(a) Find the possible values of the constant a .

[3]

$$\left(2x + \frac{a}{x^2}\right)^5 = (2x)^5 + 5(2x)^4\left(\frac{a}{x^2}\right) + 10(2x)^3\left(\frac{a}{x^2}\right)^2 + \dots$$

$$\rightarrow 10 \times 8x^3 \times \frac{a^2}{x^4}$$

$$= 80a^2 \times \frac{1}{x}$$

$$\text{coeff} = 720: 80a^2 = 720$$

$$a^2 = 9$$

$$\underline{a = 3} \text{ or } \underline{a = -3}$$

(b) Hence find the coefficient of $\frac{1}{x^7}$ in the expansion.

[2]

$$\left(2x + \frac{a}{x^2}\right)^5 = (2x)^5 + 5(2x)^4\left(\frac{a}{x^2}\right) + 10(2x)^3\left(\frac{a}{x^2}\right)^2 + 10(2x)^2\left(\frac{a}{x^2}\right)^3 + \dots$$

$$\dots + 5(2x)\left(\frac{a}{x^2}\right)^4 + \left(\frac{a}{x^2}\right)^5$$

$$\rightarrow 5(2x) \times \frac{a^4}{x^8}$$

$$= 10 \times a^4 \times \frac{1}{x^7}$$

$$10 \times 81 \times \frac{1}{x^7}$$

$$\text{coeff} = \underline{810}$$

$$\text{sub. } a = \pm 3: 10 \times (3)^4 \times \frac{1}{x^7}$$

- 3 (a) Find the first three terms in ascending powers of x of the expansion of $(1 + 2x)^5$. [2]

$$(1 + 2x)^5 = 1^5 + 5 \times 1^4 \times (2x) + 10 \times 1^3 \times (2x)^2 + \dots$$

$$= \underline{1 + 10x + 40x^2 + \dots}$$

- (b) Find the first three terms in ascending powers of x of the expansion of $(1 - 3x)^4$. [2]

$$(1 - 3x)^4 = 1^4 + 4 \times 1^3 \times (-3x) + 6 \times 1^2 \times (-3x)^2 + \dots$$

$$= \underline{1 - 12x + 54x^2 + \dots}$$

- (c) Hence find the coefficient of x^2 in the expansion of $(1 + 2x)^5(1 - 3x)^4$. [2]

$$(1 + 10x + 40x^2 + \dots)(1 - 12x + 54x^2 + \dots)$$

$$\text{coeff of } x^2: 54x^2 - 120x^2 + 40x^2$$

$$= -26x^2$$

$$\text{coeff} = \underline{\underline{-26}}$$

4 Find the term independent of x in the expansion of each of the following:

(a) $\left(x + \frac{3}{x^2}\right)^6$

$$\left(x + \frac{3}{x^2}\right)^6 = x^6 + 6x^5\left(\frac{3}{x^2}\right) + 15x^4\left(\frac{3}{x^2}\right)^2 + 20x^3\left(\frac{3}{x^2}\right)^3 + 15x^2\left(\frac{3}{x^2}\right)^4 + 6x\left(\frac{3}{x^2}\right)^5 + \left(\frac{3}{x^2}\right)^6$$

$$\begin{aligned} * 15x^4\left(\frac{3}{x^2}\right)^2 &= 15x^4 \times \frac{9}{x^4} \\ &= 15 \times 9 \\ &= \underline{135} \end{aligned}$$

(b) $(4x^3 - 5)\left(x + \frac{3}{x^2}\right)^6$ [4]

$$\begin{aligned} * 20x^3\left(\frac{3}{x^2}\right)^3 &= 20x^3 \times \frac{27}{x^6} \\ &= \frac{540}{x^3} \end{aligned}$$

$$\rightarrow (4x^3 - 5)\left(135 + \frac{540}{x^3}\right)$$

$$= 4x^3 \times \frac{540}{x^3} - 5 \times 135$$

$$= 2160 - 675$$

$$= \underline{1485}$$

- 4 The coefficient of x^2 in the expansion of $\left(1 + \frac{2}{p}x\right)^5 + (1 + px)^6$ is 70.

Find the possible values of the constant p .

[6]

$$\left(1 + \frac{2}{p}x\right)^5 = 1^5 + 5 \times 1^4 \times \left(\frac{2}{p}x\right) + \underline{10 \times 1^3 \times \left(\frac{2}{p}x\right)^2}$$

$$\rightarrow 10 \times \frac{4}{p^2} x^2$$

$$= \frac{40}{p^2} x^2$$

$$(1 + px)^6 = 1^6 + 6 \times 1^5 \times (px) + \underline{15 \times 1^4 \times (px)^2}$$

$$\rightarrow 15p^2 x^2$$

coeff of x^2 : $\frac{40}{p^2} x^2 + 15p^2 x^2$

$$\text{coeff} = \frac{40}{p^2} + 15p^2$$

$$\rightarrow \frac{40}{p^2} + 15p^2 = 70$$

$\times p^2 \quad \times p^2 \quad \times p^2$

$$40 + 15p^4 = 70p^2$$

$$15p^4 - 70p^2 + 40 = 0$$

$$3p^4 - 14p^2 + 8 = 0$$

Let $Y = p^2$:

$$3Y^2 - 14Y + 8 = 0$$

$$(3Y - 2)(Y - 4) = 0$$

$$3Y - 2 = 0 \text{ or } Y - 4 = 0$$

$$Y = \frac{2}{3} \text{ or } Y = 4$$

$$\rightarrow p^2 = \frac{2}{3} \text{ or } p^2 = 4$$

$$\underline{p = \pm \sqrt{\frac{2}{3}}} \text{ or } \underline{p = \pm 2}$$

- 4 The coefficient of x in the expansion of $\left(4x + \frac{10}{x}\right)^3$ is p . The coefficient of $\frac{1}{x}$ in the expansion of $\left(2x + \frac{k}{x^2}\right)^5$ is q .

Given that $p = 6q$, find the possible values of k .

[5]

$$\left(4x + \frac{10}{x}\right)^3 = (4x)^3 + \underline{3(4x)^2\left(\frac{10}{x}\right)} + \dots$$

$$\rightarrow 3 \times 16x^2 \times \frac{10}{x}$$

$$= 480x$$

$$\rightarrow \underline{p = 480}$$

$$\left(2x + \frac{k}{x^2}\right)^5 = (2x)^5 + 5(2x)^4\left(\frac{k}{x^2}\right) + \underline{10(2x)^3\left(\frac{k}{x^2}\right)^2} + \dots$$

$$\rightarrow 10 \times 8x^3 \times \frac{k^2}{x^4}$$

$$= 80k^2 \times \frac{1}{x}$$

$$\rightarrow \underline{q = 80k^2}$$

$$p = 6q: \quad 480 = 6 \times 80k^2$$

$$480 = 480k^2$$

$$k^2 = 1$$

$$\underline{k = -1} \text{ or } \underline{k = 1}$$

- 3 The coefficient of x^4 in the expansion of $\left(2x^2 + \frac{k^2}{x}\right)^5$ is a . The coefficient of x^2 in the expansion of $(2kx - 1)^4$ is b .

(a) Find a and b in terms of the constant k .

[3]

$$\left(2x^2 + \frac{k^2}{x}\right)^5 = (2x^2)^5 + 5(2x^2)^4\left(\frac{k^2}{x}\right) + \underline{10(2x^2)^3\left(\frac{k^2}{x}\right)^2} + \dots$$

$$\rightarrow 10 \times 8x^6 \times \frac{k^4}{x^2}$$

$$= 80k^4 x^4$$

$$\rightarrow \underline{a = 80k^4}$$

$$(2kx - 1)^4 = (2kx)^4 + 4(2kx)^3(-1) + \underline{6(2kx)^2(-1)^2} + \dots$$

$$\rightarrow 6 \times 4k^2 x^2$$

$$= 24k^2 x^2$$

$$\rightarrow \underline{b = 24k^2}$$

- (b) Given that $a + b = 216$, find the possible values of k .

[3]

$$80k^4 + 24k^2 = 216$$

$$10k^4 + 3k^2 = 27$$

$$10k^4 + 3k^2 - 27 = 0$$

Let $X = k^2$:

$$10X^2 + 3X - 27 = 0$$

$$X = \frac{-3 \pm \sqrt{3^2 - 4(10)(-27)}}{2(10)}$$

$$X = \frac{3}{2} \quad \text{or} \quad X = \frac{-9}{5}$$

$$k^2 = \frac{3}{2} \quad \text{or} \quad k^2 = \frac{-9}{5}$$

$$k = \pm \sqrt{\frac{3}{2}}$$

no solⁿs

- 5 In the expansion of $(a + bx)^7$, where a and b are non-zero constants, the coefficients of x , x^2 and x^4 are the first, second and third terms respectively of a geometric progression.

Find the value of $\frac{a}{b}$.

[5]

$$(a + bx)^7 = a^7 + 7a^6(bx) + 21a^5(bx)^2 + 35a^4(bx)^3 + 35a^3(bx)^4 + \dots$$

$$= a^7 + 7a^6bx + 21a^5b^2x^2 + 35a^4b^3x^3 + 35a^3b^4x^4 + \dots$$

$$\text{coeff of } x = 7a^6b$$

$$\text{coeff of } x^2 = 21a^5b^2$$

$$\text{coeff of } x^4 = 35a^3b^4$$

geometric progression: $7a^6b$, $21a^5b^2$, $35a^3b^4$

① ② ③

common ratio: ② ÷ ①: $\frac{21a^5b^2}{7a^6b} = \frac{3b}{a}$ (A)

③ ÷ ②: $\frac{35a^3b^4}{21a^5b^2} = \frac{5b^2}{3a^2}$ (B)

(A) = (B):

$$\frac{3b}{a} = \frac{5b^2}{3a^2}$$

$$9a^2b = 5ab^2$$

$$\div ab$$

$$\div ab$$

$$9a = 5b$$

$$\frac{a}{b} = \frac{5}{9}$$