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Year 4 Mathematics 1 Binomial Theorem Supplementary Worksheet 1

 Name : ______()
 Class : _____ Date : ______

(i) Write down and simplify the fourth term, in descending powers of x, in the expansion of $\left(ax - \frac{b}{x}\right)^n$. [2]

- (ii) If this fourth term is independent of x, find the value of n. [2]
- (iii) With the value of n found in part (ii), calculate the value of ab if the fourth term is equal to -160. [2]

[2008 ACS (Barker Road) AMaths P1 (modified)]

2 Given that the coefficient of x^4 in the expansion of $\left(x^3 - \frac{m}{x}\right)^8$ is -13608,

- (i) find the value of the constant m, [4]
- (ii) hence find the term independent of x in the expansion of $\left(1+\frac{2}{x^4}\right)\left(x^3-\frac{m}{x}\right)^\circ$. [3] [2008 ACS (1) AMaths P2]

3 Write down and simplify the first 3 terms, in ascending powers of x, in the expansion of $\left(2-\frac{x}{3}\right)^5$. Given that the first three terms in the expansion of $\left(1+px+x^2\left(2-\frac{x}{3}\right)^5\right)^5$ are $32-qx+2qx^2$, find the value of p. [6]

[2008 Anderson Sec AMaths P1]

4 (i) Write down the first three terms of the expansion, in ascending powers of x, of $(1+ax)^n$, where a and n are constants. [2]

(ii) Hence find the value of a and of n if $(1+ax)^n = 1-20x+195x^2+...$, taking up to the term in x^2 . [6]

[2008 Anglican High AMaths P1]

5 Given that $(1+px)^n = 1 - 32x + 448x^2 + qx^3 + ...$, find the value of p, of q and of n. [6] [2008 CHIJ St Nicholas Girls' AMaths P1] (i) Write, in ascending powers of x, the first three terms in the expansion of $\left(2-\frac{x}{3}\right)^4$.[2]

(ii) The coefficients of x and x^2 in the expansion of $(p-x^2)\left(2-\frac{x}{3}\right)^4$ are in the ratio of 2 : 3. Find the value of p. [3] [2008 Balestier Hill Sec AMaths P2]

7 (i) Write down the first three terms in the expansion, in ascending powers of x, of $\left(1 + \frac{px^2}{2}\right)^8$, where p is a constant. [2]

(ii) The first three terms in the expansion of $(2+qx^2)\left(1+\frac{px^2}{2}\right)^8$, where p and q are integers, are $2-5x^2+2x^4$. Find the values of p and q, and show that p-q<0.[6]

[2008 Cedar Girls' Sec AMaths P1]

8 Find in ascending powers of x, the first three terms in the expansion of

- (i) $(2+x)^5$,
- (ii) $(1+ax)^6$.

Given that the coefficient of x^2 in the expansion of $(2+x)^5 (1+ax)^6$ is 2960, find the possible value(s) of a. [5]

[2008 CHIJ Toa Payoh Sec AMaths P1]

9 The coefficient of x in the expansion of $\left(2+\frac{x}{3}\right)^n$ is 3 times the coefficient of x^2 .

(a) Find the value of n. [3]

(b) Hence evaluate the coefficient of
$$x^2$$
 in the expansion $(x-3)^2 \left(2+\frac{x}{3}\right)$. [2]

[2008 Commonwealth Sec AMaths P1]

2

10 (i) Find the term independent of x in the expansion of
$$\left(2x - \frac{3}{x}\right)^8$$
. [3]

(ii) Expand $(1 + x)^n (1 - 3x)^2$ in ascending powers of x up to the term x^2 , where n is a positive integer greater than 1. If the coefficient of x^2 is 3, find the value of n. [4] [2008 Crescent Girls' AMaths P1]

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11 (i) Expand
$$(1+x+x^2)^{10}$$
 in ascending powers of x up to the term in x^3 . [3]

(ii) Hence, evaluate $(1.0101)^{10}$ correct to 3 decimal places. [3]

[2008 Clementi Woods Sec AMaths P2]

12 (a) Write down the first three terms in the expansion, in ascending powers of x, of $\left(2-\frac{x}{2}\right)^8$. [2]

(b) The coefficients of x and x^2 in the expansion of $\left(2 - \frac{x}{2}\right)^8 \left(4 + ax + bx^2\right)$ are 1536 and -512 respectively. Calculate the value of a and of b. [5] [2008 Holy Innocents High AMaths P1]

13 Write down and simplify, in ascending powers of *x*, the first three terms of the expansion of $(x^3)^5$

(a)
$$\left(1+\frac{x}{2}\right)$$
, (b) $(3-2x)^5$.

Hence, or otherwise, obtain the first three terms of the expansion of $\left(3 - \frac{x}{2} - x^2\right)^3$ and use it to estimate the value of $(2.94)^5$ correct to 3 decimal places. [8]

[2008 Maris Stella High AMaths P1]

14 In the expansion of
$$\left(x^2 - \frac{p}{2x}\right)^9$$
 where p is a positive constant, the term independent of x is 5376

5376.

- (i) Show that p = 4. [4]
- (ii) With this value of p, find the coefficient of x^9 in the expansion of

$$\left(x^2 - \frac{p}{2x}\right)^9 \left(9x^9 + 1\right).$$
[4]

[2008 Ngee Ann Sec AMaths P1]

15 (i) Write down the first three terms in the expansion, in descending powers of x, of $\left(x + \frac{2a}{x}\right)^6$, where a is a constant. [2]

(ii) The first three terms in the expansion, in descending powers of x, of $(1+bx^2)\left(x+\frac{2a}{x}\right)^6$ where a and b are integers, are $bx^8+25x^6+264x^4+...$ Find the value of a and of b. [5]

[2008 Singapore Chinese Girls' AMaths P2]

16 (a) The coefficient of x^3 in the expansion $(5+ax)\left(1-\frac{x}{2}\right)^{10}$ is -30. Find the value of *a*. [4]

(b) In the expansion of
$$\left(x^2 - \frac{2}{x}\right)^n$$
, the fifth term is independent of x. Find the value of n . [3]

[2008 Tanjong Katong Sec AMaths P2]

17 (a) Expand $(2-p)^5$ completely. Use this result to write down the expansion of $\left(2-\frac{x}{2}+x^2\right)^5$, in ascending powers of x, as far as the term in x^2 . [4]

(**b**) Find the coefficient of
$$x^8$$
 in the expansion of $(2-x)^{10}\left(1+\frac{2}{x}\right)^{10}$. [4]

[2008 Temasek Sec AMaths P2 (modified)]

18 (i) Find, in the simplest form,

- (a) the full expansion of $(1-3x)^5$, [2]
- (b) the coefficient of x^3 in the expansion $(1+2x)(1-3x)^5$. [2]

(ii) Find the term independent of x in the expansion of $\left(9x - \frac{1}{3x}\right)^{18}$, expressing your answer in the form $-a \times 3^{b}$ where a and b are positive integers. [4] [2008 Unity Sec AMaths P2]

19 (i) Write down the first three terms in the expansion, in ascending powers of x, of $(3+ax)^6$, where a is a constant. [2]

(ii) The first three terms in the expansion of $(b-3x)(3+ax)^6$ are $2187+2187x+cx^2$. Find the values of the constants *a*, *b* and *c*. [4] [2008 Victoria School AMaths P1]

20 Write down the first three terms in the expansion, in descending powers of x, of $\left(ax - \frac{b}{x^3}\right)^{\circ}$. Hence evaluate the term independent of x of $\left(5x - \frac{1}{x^3}\right)^{\circ}$. [4]

[2008 Zhonghua Sec AMaths P1]

- 21 Write down and simplify the following binomial expansions.
 - (a) $(2-x)^3$ (b) $(x+2y)^4$

22 In the expansion of
$$\left(x^3 - \frac{2}{x^2}\right)^{10}$$
, find

(i) the coefficient of
$$\frac{1}{x^5}$$
, (ii) the constant term.

23 (i) Determine the coefficients of x^5 and x^7 in the expansion of $\left(\frac{2}{x} + x\right)^5$.

(ii) Given that the coefficient of x^7 in the expansion $\left(\frac{2}{x}+x\right)^9 \left(px+1\right)^2$ is 1746, find the value of p, where p is a positive real number.

- 24 Expand $(1 + 2x 3x^2)^{12}$ in ascending powers of x up to the term in x^3 . Hence estimate the value of $(1.0197)^{12}$, leaving your answer correct to 4 significant figures.
- 25 In the binomial expansion of $\left(1+\frac{x}{4}\right)^n$ in ascending powers of x, the coefficient of the third term is twice that of the fourth term. Calculate the value of n. Hence, evaluate the middle term of this expansion.
- 26 In the expansion of $(3x+2)^{19}$, the coefficients of the term in x^k and the term in x^{k+1} are equal. Calculate the value of k.
- 27 It is given that in the expansion of $(1 + \alpha x + \beta x^2)^6$ in ascending powers of x, the coefficient of x^2 is zero and the coefficient of x^3 is -440. Determine the value of α and of β .
- 28 (a) Find the fifth and sixth terms, in ascending powers of x, in the binomial expansion of $\left(1-\frac{1}{3}x^2\right)^9$.
 - (b) Hence find the coefficient of x^{10} in the expansion of $\left(1-\frac{1}{3}x^2\right)^3 (3x^2-1)$.

[2009 River Valley High]

- 29 (a) Write down and simplify the first four terms in the expansion of $\left(x^2 \frac{2}{x}\right)^8$ in descending powers of x. Hence find the coefficient of x^{10} in the expansion of $\left(2x^3 + 5\left(x^2 \frac{2}{x}\right)^8\right)$.
 - (b) In the binomial expansion of $(3+kx^2)^n$, where $n \ge 3$ and k is a constant, the coefficient of is twice the coefficient of x^2 . Express k in terms of n.

[2009 Commonwealth Secondary School]

- 30 (i) In the binomial expansion of $\left(x^2 \frac{3}{\sqrt{x}}\right)^{10}$, find the coefficient of the term in x^5 .
 - (ii) Find the coefficient of x^{10} in the expansion of $\left(2-3x^5\left(x^2-\frac{3}{\sqrt{x}}\right)^{10}\right)$. [2009 Anglican High School]

31 (a) Expand, in ascending powers of x up to the term x^2 for (i) $\left(1+\frac{x}{3}\right)^5$ and (ii) $\left(3-x^2\right)^5$. Hence find the coefficient of x^2 in the expansion of $\left(1+\frac{x}{3}\right)^5 \left(3-x^2\right)^5$. (b) Evaluate the coefficient of the term x in the expansion of $\left(\frac{x}{2}-\frac{1}{3x^2}\right)^7$.

32 (i) Write down the first four terms of the expression $\left(x^2 - \frac{3}{x}\right)^7$ in descending powers of x.

(ii) Hence, find the coefficient of
$$x^{14}$$
 in the expansion of $\left(x^3 - 1\right)^2 \left(x^2 - \frac{3}{x}\right)^2$

[2010 Fairfield Methodist School]

- 33 (a) In the expansion of $(2 + ax)(1 + bx)^6$, where *a* and *b* are constants and *a* is a positive integer, the first two non-zero terms are 2 and $-168x^2$. Find the value of *a* and of *b*.
 - (b) Find the term independent of x in the expansion of $\left(x \frac{2}{x^2}\right)^6$.

[2009 Catholic High School]

^{[2009} Crescent Girls' School]

- 34 (a) (i) Obtain the first three terms in the expansion of $\left(2-\frac{1}{2x}\right)^3$ in descending powers of x.
 - (ii) Given that the term independent of x in the expansion of $\left(2 \frac{1}{2x}\right)^{5} (5x + p)$ is 56, find the value of p.
 - (b) In the binomial expansion of $(3 + x)^n$, the coefficient of x and x^2 are equal. Find the value of n.

[2009 St. Anthony Canossian Secondary School]

35 In the binomial expansion of $\left(x+\frac{2}{x}\right)^n$, where *n* is a positive integer, the coefficient of the third term is 420.

(a) Show that n = 15.

(b) Using the value of *n* found in part (a), find the coefficient of x^8 in the expansion of $\left(x + \frac{2}{x}\right)^n \left(3x - \frac{1}{x}\right)$.

[2010 Tanjong Katong Secondary School]

- 36 (a) In the expansion of $(1+kx)^n$, the second and the third term are $-\frac{9}{2}x$ and $9x^2$ respectively. Find the value of k and of n. [5]
 - (b) In the expansion of $\left(x \frac{1}{x^2}\right)^{20}$, (i) Find the term in x^{-1} .
 - (i) Find the term in x^{-1} . [2]

(ii) Hence, determine the constant term in the expansion $(1+x)\left(x-\frac{1}{x^2}\right)^{20}$. [2] [2011 Anglican High School AMaths P2]

37 (a) Write down and simplify the first four terms, in ascending powers of x, in the expansion of $(2-3x)^5$. Hence, find the coefficient of x^3 in the expansion of $(1+2x^2)(2-3x)^5$. [4]

(b) Find the possible values of *n* in the expansion of $\left(x - \frac{1}{2x^2}\right)^n$ where the expansion does not have a term that is independent of *x*. [4]

[2011 Anderson Secondary AMaths P2]

38 (a) The term independent of x in the binomial expansion of $\left(x^3 - \frac{a}{x^2}\right)^{10}$ is 13440. Find the value of a. [3]

(b) Given that $(1 + px)^n = 1 - 12x + 15p^2x^2 + qx^3 + \dots$ Find the value of *n*, *p* and *q*. [4] [2011 Balestier Hill Secondary School AMaths P1]

39 (a) Given that the coefficient of x^2 in the expansion of $(k+x)\left(2-\frac{x}{3}\right)^6$ is 16, find the value of the constant k. [4]

(b) Find the term independent of x in the expansion of $\left(2x^2 - \frac{1}{3x^3}\right)^{10}$. [3]

[2011 Catholic High School AMaths P1]

40 The first three terms in the expansion $(1-px)^n$ are $1-\frac{1}{2}nx+\frac{15}{4}x^2$. Find the values of *n* and *p*. Hence find the 4th term. [5] [2011 Bukit Panjang Government School AMaths P2]

41 (a) Write down and simplify the first 3 terms, in ascending powers of x, in the expansion of $\left(2-\frac{x}{3}\right)^5$. [3]

(b) Given that the first three terms in the expansion of $(1 + hx + x^2)(2 - \frac{x}{3})^3$ are $32 - kx + 2kx^2$, find the value of *h*. [5]

[2011 Cedar Girls' Secondary School AMaths P2]

42 (a) In the binomial expansion of $\left(1-\frac{x}{3}\right)^n$, where *n* is a positive integer, the coefficient of x^2 is $3\frac{1}{9}$. Find the value of *n*. [3]

(b) (i) Given that the constant term in the binomial expansion of $\left(x + \frac{k}{x}\right)^{6}$ is -160, find the value of the constant k. [3]

(ii) Using the value of k found in part (i), show that there is no constant term in the expansion of $\left(x + \frac{k}{r}\right)^6 \left(2x^2 + 3\right)$. [3]

[2011 CHIJ St Nicholas Girls' School AMaths P2]

8

(a) In the expansion of $\left(2x + \frac{k}{x}\right)^{13}$, where k is a positive constant, the ratio of the

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coefficient of x^3 to the coefficient of $\frac{1}{x}$ is 3 : 2. Find the value of k. [4]

(b) Using the value of k found in (a), find the coefficient of x in the expansion of $\left(3x^2 - \frac{2}{x^2}\right)\left(2x + \frac{k}{x}\right)^{13}$. [3]

[2011 CHIJ Toa Payoh Main Secondary School AMaths P2]

44 (a) In the expansion of $(2+5x)^n$, the coefficients of x^2 and x^3 are in the ratio 1 : 5, find the value of *n*. [4]

(b) With this value of *n*, find the coefficient of x^3 in the expansion of $(3-2x)(2+5x)^n$. [3]

[2011 Chung Cheng High School AMaths P1]

45 (a) Write down and simplify the first three terms of
$$\left(1 - \frac{a}{x}\right)^n$$
. [2]

(b) Given that both the coefficients of $\frac{1}{x}$ and $\frac{1}{x^2}$ are 3, find the value of *a* and of *n*. [3] [2011 Fairfield Methodist Secondary School AMaths P1]

46 (a) Calculate the term independent of x in the binomial expansion of
$$\left(x - \frac{1}{2x^3}\right)^8$$
. [2]

(b) In the binomial expansion of $(1+2x)^n$, where $n \ge 1$, the sum of the coefficients of x and x^2 is 128,

- (i) find the value of n, [3]
- (ii) find the ratio of coefficient of x^5 and x^6 . [2]

[2011 Greenview Secondary School AMaths P1]

47 Given that the first three terms in the expansion of $(a-5x)\left(1-\frac{x}{4}\right)^n$ are $8-19x+kx^2$, find the values of *a*, *n* and *k*. [6]

[2011 Hwa Chong Institution AMaths P1]

48 In the expansion of $\left(x^2 + \frac{1}{3x}\right)^n$, the fourth term and the third term have coefficients in the ratio 7 : 9. Find

- (a) *n* [4]
- (b) the term independent of x.

[2011 Holy Innocents' High School AMaths P2]

[4]

49 Find the value of *n* in $\left(x - \frac{2}{x^2}\right)^n$ if

- (a) the ratio of the coefficient of the 4th term to the coefficient of 6th term in its Binomial expansion is 5: 12.
- (b) the sixth term in its Binomial expansion is independent of x. [2] [2011 Hougang Secondary School AMaths P1]

50 (a) Find the coefficient of
$$a^4b^4$$
 in the expansion of $\left(a + \frac{b}{2}\right)^8$. [3]

(b) Find the term independent of x in the expansion of $(2x-1)^3 \left(2+\frac{1}{x}\right)^8$. [5]

[2011 Kranji Secondary School AMaths P2]

51 (a) Write down the first three terms in the expansion, in ascending powers of x, of $\left(1-\frac{x}{2}\right)^n$, where n is a positive integer. [3]

(b) The first three terms in the expansion, in ascending powers of x, of $(3x+2)\left(1-\frac{x}{2}\right)^n$ are $p+qx+2x^2$, where p and q are constants. Find the values of p, q and n. [5] [2011 Maris Stella High School AMaths P2]

52 (a) Given that the coefficient of the middle term in the binomial expansion of $\left(2x - \frac{k}{x^2}\right)^{10}$ is -252, find the value of constant k. [3]

(b) Using the value found in part (a), find the coefficient of x^4 in the expansion of $\left(x^3 - 4\left(2x - \frac{k}{x^2}\right)^{10}\right)$. [5]

[2011 Methodist Girls' School AMaths P2]

53 (a) Given that the term independent of x in the binomial expansion of $\left(\frac{1}{x^2} - \frac{x^5}{k}\right)^2$ is $2\frac{1}{3}$, find the value of the positive constant k. [4]

(b) Using the value of k found in part (a), find the coefficient of the x^7 term in the expansion $\left(2 - x^7\right) \left(\frac{1}{x^2} - \frac{x^5}{k}\right)^7$. [4]

[2011 Montfort Secondary School AMaths P2]

54 Expand $(1+2x)^n$ in increasing powers of x up to the first three terms. Given that the ratio of the coefficient of the 3rd term to the 2nd term is 7 : 1, show that n = 8. Hence, or otherwise, find the coefficient of the term in x^2 in the expansion $(1+2x+2x^2)^8$. [6]

[2011 Nan Chiau High School AMaths P1]

55 (a) The binomial expansion of $\left(2x+\frac{1}{4}\right)^9$, in ascending powers of x is

 $512x^9 + 576x^8 + ax^7 + bx^6 + \dots$ Find the value of *a* and of *b*. [3]

(b) Find the coefficient of x^6 in the expansion of $\left(2x + \frac{1}{4}\right)^9 \left(\frac{4}{x} - 1\right)^2$. [4]

[2011 North Vista Secondary School AMaths P2]

56 (a) Find the 6th term in the binomial expansion of
$$\left(\frac{x}{3} + \frac{5}{x}\right)^{12}$$
. [3]

(b) Given that the expansion of
$$\left(1-\frac{x}{2}\right)^n (3-x)$$
 is $p-13x+5qx^2+...$, find the values of n, p and q . [6]

[2011 Orchid Park Secondary School AMaths P2]

- 57 (a) The first 3 terms in the expansion of $(a + bx)(1 3x)^8$, in ascending powers of x, are $5 113x + cx^2$. Find the values of a, b and c. [5]
 - (b) (i) Find, in ascending powers of x, the first 4 terms in the expansion of $(3 5x)^6$.[2]
 - (ii) Hence, estimate the value of 2.95^6 correct to 2 decimal places.

[2011 Peirce Secondary School AMaths P2]

[2]

58 Evaluate the coefficients of x^{-4} and x^{-8} in the binomial expansion of $\left(x - \frac{3}{x^3}\right)^8$.

Hence, find the coefficient of x^{-4} in the expansion of $\left(x^4 + 2\right)\left(x - \frac{3}{x^3}\right)^8$. [7]

[2011 St Anthony's Canossian Secondary School AMaths P2]

59 (a) Write down the first three terms in the expansion, in ascending powers of x, of $\left(3 - \frac{x^2}{9}\right)^n$, where *n* is a positive integer.

The first two terms in the expansion $\left(1 + \frac{2x^2}{9}\right) \left(3 - \frac{x^2}{9}\right)^n$, in ascending powers of x, are

 $p + qx^4$, where p and q are constants.

- (b) Find the value of *n*.
- (c) Hence, find the value of p and q.

- 60 (a) In the expansion of $(1+3x)^n$ the sum of the coefficients of x and x^2 terms is 105. Find the value of n where n is a positive integer. [3]
 - (b) Find the term independent of x in the expansion of $x\left(3x-\frac{2}{x}\right)^3$. [4]

[2011 Tanjong Katong Girls' School AMaths P2]

61 (a) Find the coefficient of
$$x^3$$
 and of x^6 in the expansion of $\left(3x^2 - \frac{1}{x}\right)^9$. [3]

(b) Given that the coefficient of x^6 in the expansion of $\left(3x^2 - \frac{1}{x}\right)^9 \left(kx^3 + \frac{1}{3}\right)$ is 35721, find the value of k. [3]

[2011 Victoria School AMaths P1]

62 (a) Given that the expansion of $(a+x)(1-2x)^n$ in ascending powers of x is $4-39x+bx^2+...$, find the values of the constant a, b and n. [5]

(b) Find the coefficient of
$$x^{-11}$$
 in the expansion of $\left(x^2 - \frac{1}{x}\right)^{20}$. [4]

[2011 Woodlands Ring Secondary School AMaths P1]

63 (a) Find, in ascending powers of x, the first three terms in the expansion of $(2-x)^7$.[2] Hence, find the value of the constant a for which the coefficient of x^2 in the expansion of $(a-x)(2-x)^7$ is 616. [2]

(b) In the expansion of $\left(x^2 - \frac{1}{2x^4}\right)^n$ in descending powers of x, the sixth term is independent of x. Find the value of n and the value of this term. [4] [2011 Zhonghua Secondary School AMaths P1]

<u>Answers :</u>

 $-\binom{n}{3}a^{n-3}b^3x^{n-6}$ (ii) 6 2 1 **(i)** (iii) (ii) 2 -6804(i) $32 - \frac{80}{3}x + \frac{80}{9}x^2 + \dots$; $p = \frac{1}{3}$ 3 $1 + nax + \frac{n(n-1)}{2}a^2x^2 + ...$ n = 40, $a = -\frac{1}{2}$ (i) 4 (ii) p = -4, q = -3584, n = 85 (i) $16 - \frac{32}{2}x + \frac{8}{2}x^2 + \dots$ (ii) $\frac{6}{7}$ 6 $1+4 px^2+7 p^2 x^4+...$ 7 p = -1, q = 3(i) (ii)

Math 1_Binomial Theorem (Compiled by Lim CH & J Goh)

8 (i)
$$32 + 80 x + 80 x^2 + ... (ii) 1 + 6ax + 15a^2x^2 + ... ; a - 3 or 2
9 (i) 5 (ii) -48
10 (i) 90720 (ii) 1 -(n+6)x + $\left[\frac{n(n-1)}{2} - 6n + 9\right]x^2 + ... ; n = 12$
11 (i) 1 + 10x + 55x^2 + 210x^3 + ... (ii) 1.106
12 (a) 256 - 512x + 448x^2 + ... (b) 243 - 810x + 1080x^2 + ... ; 243 - $\frac{405}{2}x - \frac{675}{2}x^2 + ... ;$
219.375
14 (ii) 47712
15 (i) $x^6 + 12ax^4 + 60a^2x^3 + ... (ii) a = 2, b = 1$
16 (a) $a = 4$ (b) $n = 6$
17 (a) $32 - 80p + 80p^2 - 40p^2 + 10p^4 - p^5; 32 - 40x + 100x^2 + ... (b) -40$
18 (i)(a) 1 - 15x + 90x^2 - 270x^3 + 405x^4 - 243x^5 (b) -90 (c) -48620x^3^9$$

19 (i) 729 + 1458ax^2 + 1215a^2x^3 + ... (ii) a = 1, b = 3, c = -729
20 $a^3x^3 - 8a^5x^4 + 28a^6b^4 + ...; 437500$
21 (a) $8 - 12x + 6x^2 - x^3$ (b) $x^4 + 8x^3y + 24x^2y^2 + 32xy^3 + 16y^4$
22 (i) -15360 (ii) 13440
23 (i) 144; 18 (ii) $2\sqrt{3}$
24 $1 + 24x + 228x^2 + 968x^3 + ...; (1.0197)^{12} = 1.264$
25 $n = 8(n = 0 \text{ or } 1 \text{ rejected as } r < n); \frac{35}{128}x^4$
26 11 27 $\alpha = 2 \text{ and } \beta = -10$
28 (a) $T_c = \frac{14}{9}x^3, T_c = -\frac{14}{27}x^n$, (b) $5\frac{5}{27}$
29 (a) 336 (b) $k = \frac{12}{n-1}$
30 (i) 153 090 (ii) -425 250
31 (a)(i) 1 + $\frac{5}{3}x + \frac{10}{9}x^2 + ... (ii) 243 - 405x^2 + ..., -135$ (b) $\frac{7}{96}$
32 (i) $x^{14} - 21x^{11} + 189x^8 - 945x^5 + ... (ii) 232$
33 (a) $b = -2, a = 24$ $b = 2, a = -24(aa)$ (b) The term independent of x is 60
34 (i) $32 - \frac{40}{x^2} + \frac{2}{x^2} + ... (ii) p = 8$ (b) $n = 7$
35 (b) 61880
36 (a) $k - -\frac{1}{2}; n - 9$ (b)(i) -77520 (ii) -77520
37 (a) $32 - 240x + 720x^2 - 1080x^3 + ..., -1560$

| | (b) | n > 3r for all positive integers which is not a multiple of 3 | | | | | |
|----|------------|---|-----------------------------|--------------------|------------|--------------|----------------------------|
| 38 | (a) | <i>a</i> = 2 | (b) | n = 6, p = -2, | q = -1 | 60 | |
| 39 | (a) | <i>k</i> = 3 | (b) | $165\frac{25}{27}$ | | | |
| 40 | | $p = \frac{1}{2}, n = 6, 4th ter$ | $m = -\frac{5}{2}$ | $-x^3$ | | | |
| 41 | (a) | $32 - \frac{80}{3}x + \frac{80}{9}x^2 + \dots$ | (b) | $h = \frac{1}{3}$ | | | |
| 42 | (a) | <i>n</i> = 8 | (b)(i) | <i>k</i> = -2 | | | |
| 43 | (a) | $k = \sqrt{2}$ | (b) | 0 | | | |
| 44 | (a)(i) | n = 8 | (b) | 582400 | | | |
| 45 | (a) | $1 - \frac{na}{x} + \frac{(n^2 - n)a^2}{2x^2} +$ | | | | (b) | n = 3, a = -1 |
| 46 | (a) | 7 | (b)(i) | <i>n</i> = 8 | | (ii) | 1:1 |
| 47 | | $a = 8, n = 7, k = 19\frac{1}{4}$ | | | | | |
| 48 | (a) | <i>n</i> = 9 | (b) | $\frac{28}{243}$ | | | |
| 49 | (a) | n = 7 | (b) | <i>n</i> = 15 | | | |
| 50 | (a) | $4\frac{3}{8}$ | (b) | -1280 | | | |
| 51 | (a) | $1 - \frac{n}{2}x + \frac{n(n-1)}{8}$ | $(x^2) + (x^2)^2 + (x^2)^2$ | | (b) | p = 2 | 2, q = -5, n = 8 |
| 52 | (a) | $k = \frac{1}{2}$ | (b) | -13440 | | | |
| 53 | (a) | <i>k</i> = 3 | (b) | $-4\frac{25}{27}$ | | | |
| 54 | | 128 | | | | | |
| 55 | (a) | a = 288 and $b = 84$ | ŀ | | (b) | 6996 | |
| 56 | (a) | $1131.7x^2$ | (b) | n = 8, p = 3, q | = 5 | | |
| 57 | (a) | a = 5, b = 7, c = 1092 | (b)(i) | 729 - 7290x + | 30375 | $x^2 - 675$ | $500x^3 +$ |
| | (ii) | 659.07 | | | | | |
| 58 | | $-1512x^{-4}$, $5670x^{-8}$ a | nd 2646 | $5x^{-4}$ | | | |
| 59 | (a) | $3^n - \frac{3^n n x^2}{27} + \frac{3^n n (n-1)}{1458}$ | $\frac{1}{x^4} +$ | | (b) | <i>n</i> = 6 | (c) $p = 729, q = -21$ |
| 60 | | n = 5, -720 | | | | | |
| 61 | (a) | $-10206x^3$ and 30618 | x^6 | | (b) | k = -2 | $\frac{1}{2}$ |
| 62 | (a) | a = 4, b = 150, n = 5 | | | | (b) | -1140 |
| 63 | | $128 - 448x + 672x^2 \dots$ | $, a = \frac{1}{4}$ | | | (b) | $n = 15, -\frac{3003}{32}$ |

Math 1_Binomial Theorem (Compiled by Lim CH & J Goh)