BINOMIAL EXPANSION MARKING SCHEME

1.	$1^8 + 1^7\left(\frac{1}{2}x\right) + 1^6\left(\frac{1}{2}x\right)^2 + 1^5\left(\frac{1}{2}x\right)^3$ $1 + 8\left(\frac{1}{2}x\right) + 28\left(\frac{1}{4}x^2\right) + 56\left(\frac{1}{8}x^2\right)$ $1 + 4x + 7x^2 + 7x^3$ $1 + \frac{1}{2}(0.1) = 1.05$ $1 + 0.4 + 0.07 + 0.007$ $= 1.477$ $= 1.48$ **1989Q13**	5M
2.	$p^8 + 8p^7q + 28p^6q^2 + 56p^2q^2 +$ $56p^5q^3$ $(9.99)^8 = (p+q)^8$ $(9+0.99)^8 = (p+q)^8$ $9^8 + 8.9^7 \times 0.99 +$ $28.9^6 \times 0.99^2 + 56.9^5 \times 0.99^3$ $43046721 + 38263752.99 + 145842$ $29.07 + 3208530.396$ $= 99103233.46$ $= 99103200$ **1990Q16**	4M
3.	$15 - 14(2x) + 13(2x)^2 - 12(2x)^3 +$ $1(2x)^4 - (2x)^5$ $1 - 10x + 40x^2 - 80x^3 + 80x^4 - 32x^5$ $(1 - 2x)^5 = (1 - 0.02)^5$ $2x = 0.02$ $x = 0.01$ $; x = 0.01; 0.90392$ (to 5d.p) **1991Q16**	3M
4.	$1 - 4x + 7x^2 - 7x^3$ $(1 - \frac{1}{2}x)^8 = (1 - 0.02)^8$ $\frac{1}{2}x = 0.02$ $x = 0.04$ $1 - 4(0.04) + 7(0.04)^2 - 7(0.04)^3$ $; 0.850752$ **1992Q3**	3M
5.	$(2 + 0.002)^4$ $2^4 + 2^3(0.002) + 2^2(0.002) +$ $2(0.002)^3 + 0.002^4$ $16 + 0.064 + 0.000096$ $+ 0.000000064 + 0.000000000016$ $= 16.0609606; 16.0641$(to 4 d.p) **1993Q7**	3M
6.	$1^{10} + 1^9(2x) + 18(2x)^2 + 17(2x)^3$	4M

	$1 + 20x + 180x^2 + 960x^3$ $(1 + 2x)10 = (1 - 0.05)10$ $2x = -0.05 \quad x = -0.025$ $1 + 20(0.025) + 180(-0.025)^2$ $+ 960(-0.025)^3$ $1 - 0.5 + 0.1125 - 0.015$ $= 0.598$ (to 3d.p) **1994Q5**	
7.	$(1 + ta)^5 = 1 + 5a + 10a^2 + 10a^3 + 5a + a^5$ $(1 - 02)^5 = 1 - 5(0.2) + 10(-0.2)^2 +$ $10(-0.2)^3 + (-0.2) + (-0.2)^5$ $1 - 1 + 4 - 0.08 + 0.008 - 0.00032$ $= 0.40800 - 0.8032 = 0.00032$ $= 0.40800 - 0.8032 = 0.32768$ $= 0.3277$ **1996Q12**	B1 M1 A1 3M
8.	$(1 - 3x)^5$ $= 1 + 5(-3x) + 10(-3x)^2 + 10(-3x)^3$ $= 1 - 15x + 90x^2 - 270x^3 + \dots$ $= 3x = 0.03$ or $x = 0.1$ $(0.97)5$ $= 1 - 15(0.01) + 90(0.01)^2 - 270$ (0.0) $= 1.0 \ .15 + 0.009 - 0.00027$ $= 0.85873$ $= 0.8587$ to 4 d.p **1997Q9**	M1 A1 B1 M1 A1 5M
9.	$1 + 6 \times 15^2 + 15x^2 + 20x^2 + 6x^5 + x^6$ $1 + 6(0.03) + 15(0.03)^2 + 20(0.03)^3$ $= 1 + 0.18 + 0.135 + 0.0054$ $= 1.19404$ $= 1.194$ **1998Q13**	B1 M1 2M
10.	$(0.96)^5 = (1.0.04)^5$ $= 1 + 5(0.04) + 10(-0.04)^2 + 10(-0.04)^3$ $= 1 - 0.2 + 0.016 - 0.0000001024)$ $= 0.81536$ $(0.8153728$ or $0.8153726976)$ $= 0.8154$ (to 4 s.f) **1999Q10**	
11.	$(1 + x)^5 = 1 + 5x + 10x^3 + 10x^3 +$ $5x^4 + x^5$ $(1 = 0.04) 5 = 1 + 5(0.04) + 10(0.04)^2$ $+ 10(0.04) + 1.2166528$ $= 1.2167$ (4 d.p) **2000Q13**	B1 M1 M1 A1 4M
12.	$(2 + x)^3 = 2^5 + 2^4 \times 5x + 2^3 \times 10x^2 + 2^2 \times$ $10x^3$	

No.	Working	Marks
	$= 32 + 80x + 80x^2 + 40x^3$ $(2.03)^5 = 32 + 80 \times 0.03 + 80 \times (0.03)^2 + 40 \times (0.03)^3$ $=32 + 2.4 + 0.072 + 0.00108$ $=34.47308$ $=34.47$ (significant figures) **2001Q10**	
13.	$(a-b)^6=a^6-6a^5b-20a^3b3+20a^3b^4-6ab^3+b^6$ $1.98=2 – 0.02$ $Log^6 = 2^6\ 6(2)^5(0.02) + 15(2)^4(0.03)^2$ $= 64-3.84+0.096 \quad =60.256$ **2002Q9**	B1 B1 M1 A1
14.	a) $(8–x)^2 = 2^6–6.2^5x+15.2^4x^2-20.2^3x^3+15.2^2x^4–6.2x^5$ $= 64–192x+240x^2 –160x^3+60x^4 –12x^5+x^6$ b) $1.99^3 = (2 –0.01)^6$ $= 64 –192x+240x^3 – 160x^3$ $= 64 –1.92+0.24$ $= 62.104$ **2003Q11**	M1 A1 M1 A1 4 M
15.	$(1+x)^5 = 1 + 5x+10x^2+10x^2+5x^2+x^2$ b). $x = 0.02$ $1 +5 (-0.02) +10(-0.02)^2$ $=1 + -0.1 + 0.04$ $= 0.904$ **2004Q8**	
16.	$(3x-y)^4=(3x)^4y^0, (3x)^3y^1,(3x)^2y^2 (3x)^1y^3, (3x)^0y^4$ $=81x4 =27x3y, 9x^2y^2\ 3xy^3, y^4$ With coeff. $(3x-y)^4 =81x^4-4x27x^3y+6x9x-4x9xy^3+y^4$ $81x^4-108x^3y+54x^2y^2-36xy^3+y^4$ $x=2$ and $y=0.2$ $(6-0.2)^4=81x2$ $= 108x2x0.2x54x2^2x0.2^2$ $=205.2$ **2005Q13**	B1 M1 M1 A1
17.	$(2 + ½)^5 + 5(2^4) (\frac{1}{\sqrt{2}}) + 10 (2^3) (\frac{1}{\sqrt{2}})^2$	M1
	$=10(2^2) (\frac{1}{\sqrt{2}})^3 + 5(2) (\frac{1}{\sqrt{2}})^4 + (½)^5$ $(2 – ½)^5 = 25 -5 (2^4) (½) + 10(2^3)(\frac{1}{\sqrt{2}})^5$ $-10(2^2) (\frac{1}{\sqrt{2}})^3 + 5(2) (\frac{1}{\sqrt{2}})^4 – (\frac{1}{\sqrt{2}})^5$ $= 2 [2^5+10 (2^3) (\frac{1}{\sqrt{2}})^2 + 5 (2) (\frac{1}{\sqrt{2}})^4]$ $= 64 + 80 + 5$ $= 149$ **2006Q11**	M1 M1 A1 4 M
18.	a). $(1+ ½ x)^5 = 1^5.1.1(1.2x)^0 +5.1^4(½ x)^1 + 10.1^3(½ x)^2+10.1^2 (½ x)^3+5.1^1(½ x)^4 + 1.1^0 (½ x)^5$ $= 1 + \frac{5}{2}x + \frac{5}{2}x^2 + \frac{5}{4}x^3+\frac{5}{16}x^4+\frac{1}{32}x^5$ b). $1 \frac{1}{20} = 1 + \frac{1}{20} = \frac{1}{2}x = \frac{1}{20}\ x= \frac{1}{10}$ $(1 \frac{1}{20})^5 = 1 + \frac{5}{2}x \frac{1}{10}+\frac{5}{2}x \frac{1}{100}$ $= 1 + \frac{5}{20} + \frac{5}{200} \quad = 1 \frac{11}{40}$ **2007Q4**	M1 A1 M1 A1 4 m
19.	a). $(10 +\frac{2}{x})^5 = 10^5 + 10^4(\frac{2}{x}) + 510^3(\frac{2}{x})^3 + 5.10 (\frac{2}{x})^4$ $= 100000 + \frac{100000}{x} + \frac{40000}{x^2} + \frac{2000}{x^3} + \frac{800}{x^4} + \frac{32}{x^5}$ b). $(14^5) = 10 x \frac{2}{x})^5 \quad \frac{2}{x} =4$ $x=\frac{2}{3} = ½$ $100000 + \frac{100000}{½} + \frac{40000}{(½)^2} +\frac{2000}{(½)^3} + \frac{800}{(½)^4} + \frac{32}{(½)^5}$ $100000+20000+16000+64000+12800+1024$ $= 537824$ **2008Q8**	M1 M1 M1 A1 4 M
20.	$(2-x)^7 =2^7-7.2^6x+21.2^5x^2-3^5.2^4x3+35.2^3.x^4$ a). $-21.2^2.x^5+7.2^1.x^6-x^7$ $= 128-448x+672x^2-560x^2+280x^4-$	B1 A1

	$84x^5+14x^6-x^7$	M1
	b). $91.97)^7 = (2.0.03)^7$	
	$= 128-448(0.03)+672(0.003)^2 - 560(0.03)^3$	A1
	$= 128-13.44+0.6048-0.01512$	4 M
	$= 115.14968$	
	$= 115.1497$	
	2009Q8	
21.	(a) $(2 - x)^5 = 25 - 5(-2)^4 x + 10(2)^3$ $x^2 - 10(2)^2 x3 + 5(2)^4 - (x^5)$ $=32 - 80x + 80x^2 - 40x^3 +10x^4 - x^5$	
	(b) $(2-0.2)5 - 32 -80(0.2) + 80(0.2)^2 - 40(0.2)^3$ $= 18.88$	
	2010Q12	
22.	$(a + ½)^4$	M1
	$= a^4 + 4a^3 (^1/_2) + 6a^2 (^1/_2)^2 + 4a(^1/_2)^3 +(^1/_2)^4$	M1
	$=a^4 + 2a^3 + ^2/_3a +^1/_2a + ^1/_{16}$	A1
	$(a-^1/_2)^4$	
	$= a^4 + 4a^3 (-^1/_2) + 6a^2(-^1/_2)^2 + 4a(-^1/_2)^3 +(-^1/_2)^4$	3
	$= a^4 - 2a^3 + ^3/_2a^3 - ½ a + ^1/_{16}$	
	$(a + ½)^4 (a - ½)^4 = 2a^4 + 3a^2 + ^1/_8$	
	2011Q11	
23.	(a) $(1 + x)^7 = 1 + 7x + 21x^2 + 35x^3$	
	(b) $(0.94)^7 = [1 + (-0.06)]^7$	M1
	$= 1 + 7 \times (-0.06) + 21 \times (-0.06)^2 +35 \times (-0.06)^3$	A1
	$= 1- 0.42 + 0.0756 - 0.00756$ $= 0.64804$	
		2