1)c

4 **(i)** $\log_a p + \log_a q = 9$ $2\log_a p + \log_a q = 15$ $\log_a p = 6$ and $\log_a q = 3$	B1 B1 M1 A1 [4]	 M1 for solution of the two equations A1 for both
Or $a^9 = pq$ $a^{15} = p^2q$ $a^6 = p$ which leads to $\log_a p = 6$ $a^3 = q$ which leads to $\log_a q = 3$	 B1 B1 M1 A1	 M1 for complete solution of the two equations A1 for obtaining both in correct log form
Or $\log_a p^2q - \log_a pq = 6$ $\log_a \frac{p^2q}{pq} = 6$, $\log_a p = 6$ $\log_a pq = \log_a p + \log_a q = 9$ so $\log_a q = 3$	 M1 B1 B1 A1	 M1 for $\log_a p^2q - \log_a pq = 6$ B1 for $\log_a \frac{p^2q}{pq} = 6$ B1 for $\log_a pq = \log_a p + \log_a q = 9$ A1 for both
(ii) $\log_p a + \log_q a = \frac{1}{\log_a p} + \frac{1}{\log_a q}$, $= 0.5$	M1, A1 [2]	M1 for change of both to base a logarithm

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2)c

QUESTION 4

(a) 5 *A1* *N1*

(b) **METHOD 1**

$\log_2\left(\frac{32^x}{8^y}\right) = \log_2 32^x - \log_2 8^y$ *(A1)*

$= x\log_2 32 - y\log_2 8$ *(A1)*

$\log_2 8 = 3$ *(A1)*

$p = 5,\ q = -3$ (accept $5x - 3y$) *A1* *N3*

METHOD 2

$\frac{32^x}{8^y} = \frac{(2^5)^x}{(2^3)^y}$ *(A1)*

$= \frac{2^{5x}}{2^{3y}}$ *(A1)*

$= 2^{5x-3y}$ *(A1)*

$\log_2(2^{5x-3y}) = 5x - 3y$

$p = 5,\ q = -3$ (accept $5x - 3y$) *A1* *N3*

[5 marks]

M09/5/MATME/SP1/ENG/TZ2/XX

3) QUESTION 1

(a) $r = \frac{16}{32}\left(=\frac{1}{2}\right)$ *A1* *N1*

(b) correct calculation or listing terms *(A1)*

e.g. $32\times\left(\frac{1}{2}\right)^{6-1}$, $8\times\left(\frac{1}{2}\right)^{3}$, $32, \ldots 4, 2, 1$

$u_6 = 1$ *A1* *N2*

(c) evidence of correct substitution in S_∞ *A1*

e.g. $\frac{32}{1-\frac{1}{2}}$, $\frac{32}{\frac{1}{2}}$

$S_\infty = 64$ *A1* *N1*

[5 marks]

N10/5/MATME/SP1/ENG/TZ0/XX

4) **QUESTION 3**

(a) $n = 10$ *A1* *N1*

(b) $a = p, b = 2q$ (or $a = 2q, b = p$) *A1A1* *N1N1*

(c) $\binom{10}{5}p^5(2q)^5$ *A1A1A1* *N3*

[6 marks]

M09/5/MATME/SP1/ENG/TZ2/XX

5) **QUESTION 5**

(a) $\sum_{r=4}^{7} 2^r = 2^4 + 2^5 + 2^6 + 2^7$ (accept $16 + 32 + 64 + 128$) *A1* *N1*

(b) (i) **METHOD 1**

recognizing a GP *(M1)*

$u_1 = 2^4$, $r = 2$, $n = 27$ *(A1)*

correct substitution into formula for sum *(A1)*

e.g. $S_{27} = \frac{2^4(2^{27}-1)}{2-1}$

$S_{27} = 2147483632$ *A1* *N4*

METHOD 2

recognizing $\sum_{r=4}^{30} = \sum_{r=1}^{30} - \sum_{r=1}^{3}$ *(M1)*

recognizing GP with $u_1 = 2$, $r = 2$, $n = 30$ *(A1)*

correct substitution into formula for sum

$S_{30} = \frac{2(2^{30}-1)}{2-1}$ *(A1)*

$= 2147483646$

$\sum_{r=4}^{30} 2^r = 2147483646 - (2 + 4 + 8)$

$= 2147483632$ *A1* *N4*

(ii) valid reason (*e.g.* **infinite** GP, diverging series), **and** $r \geq 1$ (accept $r > 1$) ***R1R1*** *N2*

' marks]

M09/5/MATME/SP2/ENG/TZ2/XX+

6) **3.** (a) correct substitution into sum of a geometric sequence *(A1)*

e.g. $200\left(\frac{1-r^4}{1-r}\right)$, $200+200r+200r^2+200r^3$

attempt to set up an equation involving a sum and 324.8 ***M1***

e.g. $200\left(\frac{1-r^4}{1-r}\right)=324.8$, $200+200r+200r^2+200r^3=324.8$

$r=0.4$ (exact) ***A2*** ***N3***

[4 marks]

(b) correct substitution into formula ***A1***

e.g. $u_{10}=200\times 0.4^9$

$u_{10}=0.0524288$ (exact), 0.0524 ***A1*** ***N1***

[2 marks]

Total [6 marks]

M12/5/MATME/SP2/ENG/TZ2/XX

7) **1.** (a) valid method *(M1)*

e.g. subtracting terms, using sequence formula

$d=1.7$ ***A1*** ***N2***

[2 marks]

(b) correct substitution into term formula *(A1)*

e.g. $5+27(1.7)$

28th term is 50.9 (exact) ***A1*** ***N2***

[2 marks]

(c) correct substitution into sum formula *(A1)*

e.g. $S_{28}=\frac{28}{2}(2(5)+27(1.7))$, $\frac{28}{2}(5+50.9)$

$S_{28}=782.6$ (exact) [782, 783] ***A1*** ***N2***

[2 marks]

Total [6 marks]

N12/5/MATME/SP2/ENG/TZ0/XX

8)

6 **(i)** $\left(x+\frac{2}{x^2}\right)^6 = x^6 + 12x^3 + 60...$	B3 [3]	B1 for each correct term
(ii) Independent term = $(2\times'60')+(-4\times'12') = 72$	M1 A1 [2]	M1 for sum of 2 products (2 × their 60)+(–4 × their 12) A1 for 72