1.

(a)	evidence of choosing the formula for 20^{th} term	(M1)		
	e.g. $u_{20} = u_1 + 19d$			
	correct equation	A1		
	e.g. $64 = 7 + 19d$, $d = \dfrac{64-7}{19}$			
	$d = 3$	A1	N2	3
(b)	correct substitution into formula for u_n	A1		
	e.g. $3709 = 7 + 3(n-1)$, $3709 = 3n + 4$			
	$n = 1235$	A1	N1	2

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2.

(a)	common difference is 6	A1	N1
(b)	evidence of appropriate approach	(M1)	
	e.g. $u_n = 1353$		
	correct working	A1	
	e.g. $1353 = 3 + (n-1)6$, $\dfrac{1353+3}{6}$		
	$n = 226$	A1	N2
(c)	evidence of correct substitution	A1	
	e.g. $S_{226} = \dfrac{226(3+1353)}{2}$, $\dfrac{226}{2}(2 \times 3 + 225 \times 6)$		
	$S_{226} = 153\ 228$ (accept 153 000)	A1	N1

[6]

3.

(a)	interchanging x and y (seen anywhere)	(M1)	
	e.g. $x = \log\sqrt{y}$ (accept any base)		
	evidence of correct manipulation	A1	
	e.g. $3^x = \sqrt{y}, 3^y = x^{\frac{1}{2}}, x = \frac{1}{2}\log_3 y, 2y = \log_3 x$		
	$f^{-1}(x) = 3^{2x}$	AG	N0
(b)	$y > 0, f^{-1}(x) > 0$	A1	N1
(c)	**METHOD 1**		
	finding $g(2) = \log_3 2$ (seen anywhere)	A1	
	attempt to substitute	(M1)	
	e.g. $(f^{-1} \circ g)(2) = 3^{\log_3 2}$		
	evidence of using log or index rule	(A1)	
	e.g. $(f^{-1} \circ g)(2) = 3^{\log_3 4}, 3^{\log_3 2^2}$		
	$(f^{-1} \circ g)(2) = 4$	A1	N1
	METHOD 2		
	attempt to form composite (in any order)	(M1)	
	e.g. $(f^{-1} \circ g)(x) = 3^{2\log_3 x}$		
	evidence of using log or index rule	(A1)	
	e.g. $(f^{-1} \circ g)(x) = 3^{\log_3 x^2}, 3^{\log_3 x^2}$		
	$(f^{-1} \circ g)(x) = x^2$	A1	
	$(f^{-1} \circ g)(2) = 4$	A1	N1

[7]

4.

recognizing $\log a + \log b = \log ab$ (seen anywhere)	(A1)	
e.g. $\log_2(x(x-2)), x^2 - 2x$		
recognizing $\log_a b = x \Leftrightarrow a^x = b$ (seen anywhere)	(A1)	
e.g. $2^3 = 8$		
correct simplification	A1	
e.g. $x(x-2) = 2^3, x^2 - 2x - 8$		
evidence of correct approach to solve	(M1)	
e.g. factorizing, quadratic formula		
correct working	A1	
e.g. $(x-4)(x+2), \frac{2 \pm \sqrt{36}}{2}$		
$x = 4$	A2	N3

[7]

5.

(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]

6.

METHOD 1

$9 = 3^2$, $27 = 3^3$ (A1)(A1)

expressing as a power of 3, $(3^2)^{2x} = (3^3)^{1-x}$ (M1)

$3^{4x} = 3^{3-3x}$ (A1)

$4x = 3 - 3x$ (A1)

$7x = 3$

$\Rightarrow x = \frac{3}{7}$ (A1) (C6)

METHOD 2

$2x\log 9 = (1-x)\log 27$ (M1)(A1)(A1)

$\frac{2x}{1-x} = \frac{\log 27}{\log 9}\left(= \frac{3}{2}\right)$ (A1)

$4x = 3 - 3x$ (A1)

$7x = 3$

$\Rightarrow x = \frac{3}{7}$ (A1) (C6)

7.

METHOD 1

$\log_{10}\left(\frac{x}{y^2\sqrt{z}}\right) = \log_{10} x - \log_{10} y^2 - \log_{10}\sqrt{z}$ (A1)(A1)(A1)

$\log_{10} y^2 = 2\log_{10} y$ (A1)

$\log_{10}\sqrt{z} = \frac{1}{2}\log z$ (A1)

$\log_{10}\left(\frac{x}{y^2\sqrt{z}}\right) = \log_{10} x - 2\log y - \frac{1}{2}\log z$

$= p - 2q - \frac{1}{2}r$ (A1) (C2)(C2)(C2)

METHOD 2

$x = 10, y^2 = 10^{2p}, \sqrt{z} = 10^{\frac{r}{2}}$ (A1)(A1)(A1)

$\log_{10}\left(\frac{x}{y^2\sqrt{z}}\right) = \log_{10}\left(\frac{10^p}{10^{2q}10^{\frac{r}{2}}}\right)$ (A1)

$= \log_{10}\left(10^{p-2q-\frac{r}{2}}\right)\left(= p - 2q - \frac{r}{2}\right)$ (A2) (C2)(C2)(C2)

[6]

8.

(a) evidence of choosing cosine rule (M1)

e.g. $a^2 + b^2 - 2ab\cos C$

correct substitution A1

e.g. $7^2 + 9^2 - 2(7)(9)\cos 120°$

AC $= 13.9$ $(= \sqrt{193})$ A1 N2 3

(b) **METHOD 1**

evidence of choosing sine rule (M1)

e.g. $\frac{\sin \hat{A}}{\text{BC}} = \frac{\sin \hat{B}}{\text{AC}}$

correct substitution A1

e.g. $\frac{\sin \hat{A}}{9} = \frac{\sin 120}{13.9}$

$\hat{A} = 34.1°$ A1 N2 3

METHOD 2

evidence of choosing cosine rule (M1)

e.g. $\cos \hat{A} = \frac{\text{AB}^2 + \text{AC}^2 - \text{BC}^2}{2(\text{AB})(\text{AC})}$

correct substitution A1

e.g. $\cos \hat{A} = \frac{7^2 + 13.9^2 - 9^2}{2(7)(13.9)}$

$\hat{A} = 34.1°$ □ A1 N2 3

[6]

9.

(a) choosing sine rule (M1)

correct substitution $\frac{\sin R}{7} = \frac{\sin 75°}{10}$ A1

$\sin R = 0.676148...$

$\text{P}\hat{\text{R}}\text{Q} = 42.5°$ A1 N2

(b) $P = 180 - 75 - R$

$P = 62.5$ (A1)

substitution into any correct formula A1

e.g. area Δ PQR = $\frac{1}{2} \times 7 \times 10 \times \sin(\text{their } P)$

= 31.0 (cm^2) A1 N2

[6]

10.

(a) finding $A\hat{B}C = 110°$ (= 1.92 radians) (A1)

evidence of choosing cosine rule (M1)

e.g. $AC^2 = AB^2 + BC^2 - 2(AB)(BC)\cos A\hat{B}C$

correct substitution A1

e.g. $AC^2 = 25^2 + 40^2 - 2(25)(40)\cos 110°$

AC = 53.9 (km) A1 N3

(b) **METHOD 1**

correct substitution into the sine rule A1

e.g. $\frac{\sin B\hat{A}C}{40} = \frac{\sin 110°}{53.9}$

$B\hat{A}C = 44.2°$ A1

bearing = 074° A1 N1

METHOD 2

correct substitution into the cosine rule A1

e.g. $\cos B\hat{A}C = \frac{40^2 - 25^2 - 53.9^2}{-2(25)(53.9)}$

$B\hat{A}C = 44.3°$ A1

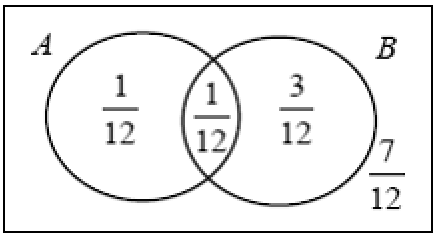
bearing = 074° A1 N1

[7]

11.

$P(A \cap B) = P(A) + P(B) - P(A \cup B)$ M1

$= \frac{2}{12} + \frac{4}{12} - \frac{5}{12} = \frac{1}{12}$ A1



M1A1

$P(A'/B') = \frac{P(A' \cap B')}{P(B')} = \frac{\frac{7}{12}}{\frac{8}{12}} = \frac{7}{8}$ M1A1

[6]

12.

(a) $P(RR) = \left(\frac{2}{5}\right)\left(\frac{1}{4}\right)$ (M1)

$= \frac{1}{10}$ A1 N2

(b) $P(RR) = \frac{4}{4+n} \times \frac{3}{3+n} = \frac{2}{15}$ A1

Forming equation $12 \times 15 = 2(4 + n)(3 + n)$ (M1)

$12 + 7n + n^2 = 90$ A1

$\Rightarrow n^2 + 7n - 78 = 0$ A1

$n = 6$ AG N0

(c) **EITHER**

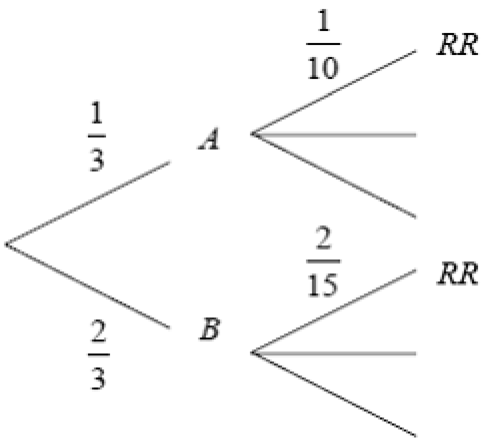
$P(A) = \frac{1}{3}$ $P(B)\frac{2}{3}$ A1

$P(RR) = P(A \cap RR) + P(B \cap RR)$ (M1)

$= \left(\frac{1}{3}\right)\left(\frac{1}{10}\right) + \left(\frac{2}{3}\right)\left(\frac{2}{15}\right)$

$= \frac{11}{90}$ A1 N2

OR



A1

$P(RR) = \frac{1}{3} \times \frac{1}{10} + \frac{2}{3} \times \frac{2}{15}$ M1

$= \frac{11}{90}$ A1 N2

(d) $P(1 \text{or } 6) = P(A)$ M1

$P(A \mid RR) = \frac{P(A \cap RR}{P(RR)}$ (M1)

$= \frac{\left[\left(\frac{1}{3}\right)\left(\frac{1}{10}\right)\right]}{\frac{11}{90}}$ M1

$= \frac{3}{11}$ A1 N2

[13]