4722 Core Mathematics 2

1	$(2 - 3x)^6 = 2^6 + 6.2^5.(-3x) + 15.2^4.(-3x)^2$	**M1**	Attempt (at least) first two terms - product of binomial coefficient and powers of 2 and (-)3x
	$= 64 - 576x + 2160x^2$	**A1**	Obtain $64 - 576x$
		M1	Attempt third term - binomial coefficient and powers of 2 and (-)3x
		A1	Obtain $2160x^2$
	OR		
		M1	Attempt expansion involving all 6 brackets
		A1	Obtain 64
		A1	Obtain $-576x$
		A1	Obtain $2160x^2$
	SR if the expansion is attempted in descending order, and the required terms are never seen, then **B1 B1 B1** for $4860x^4$, $-2916x^5$, $729x^6$		
		4	
2	**(i)** $u_2 = {}^2/_3$ $u_3 = {}^{-1}/_2$ $u_4 = 3$	**B1** **B1√** **B1√**	Obtain correct u_2 Obtain correct u_3 from their u_2 Obtain correct u_4 from their u_3
		3	
	(ii) sequence is periodic / cyclic / repeating	**B1**	Any equivalent comment
		1	
3	**(i)** $\frac{1}{2} \times 8^2 \times \theta = 48$ Hence $\theta = 1.5$ radians	**M1** **A1**	State or imply $(\frac{1}{2})\ 8^2\theta = 48$ Obtain $\theta = 1.5$ (or 0.477π), or equiv
		2	
	(ii) area $= 48 - \frac{1}{2} \times 8^2 \times \sin 1.5$ $= 48 - 31.9$ $= 16.1$	**M1*** **M1d*** **A1**	Attempt area of Δ using $(\frac{1}{2})\ 8^2 \sin\theta$ Attempt 48 – area of Δ Obtain 16.1 cm^2
		3	
4	**(i)** f(3) $= 27a - 36 - 21a + 12 = 0$ $6a = 24$ $a = 4$	**M1*** **M1d*** **A1**	**A**ttempt f(3) Equate attempt at f(3) to 0 and attempt to solve Obtain $a = 4$
	OR		
		M1*	Attempt complete division / matching coeffs
		M1d*	Equate remainder to 0
		A1	Obtain $a = 4$
		3	
	(ii) f(-2) $= -32 - 16 + 56 + 12$ $= 20$	**M1** **A1√**	Attempt f(-2) Obtain 20 (or $6a - 4$, following their a)
		2	

5 (i) $\int x\mathrm{d}y = \int ((y-3)^2 - 2)\mathrm{d}y$ **B1** Show $x = y^2 - 6y + 7$ convincingly

$= \int (y^2 - 6y + 7)\mathrm{d}y$ **A.G.** **B1** State or imply that required area = $\int x\mathrm{d}y$

$3 + \sqrt{(2+2)} = 5$, $3 + \sqrt{(14+2)} = 7$ **B1** Use $x = 2, 14$ to show new limits of $y = 5, 7$

3

(ii) $\left[\frac{1}{3}y^3 - 3y^2 + 7y\right]_5^7$ **M1** Integration attempt, with at least one term correct

$= (^{343}/_3 - 147 + 49) - (\,^{125}/_3 - 75 + 35)$ **A1** All three terms correct

$= 16^1/_3 - 1^2/_3$ **M1** Attempt F(7) – F(5)

$= 14\,^2/_3$ **A1** Obtain $14\,^2/_3$, or exact equiv

4

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6 (i) $ABC = 360 - (150 + 110) = 100^o$ **A.G.** **B1** Show convincingly that angle ABC is 100^o

1

(ii) $CA^2 = 15^2 + 27^2 - 2\times 15\times 27\times \cos 100^0$ **M1** Attempt use of correct cosine rule

$= 1094.655\ldots$

$CA = 33.1$ **A1** Obtain 33.1 km

2

(iii) $\frac{\sin C}{15} = \frac{\sin 100}{33.1}$ or $\frac{\sin A}{27} = \frac{\sin 100}{33.1}$ **M1** Attempt use of sine rule to find angle C or A (or equiv using cosine rule)

A1√ Correct unsimplified eqn, following their CA

$C = 26.5^o$ $A = 53.5^o$ **A1** Obtain $C = 26.5^o$ or $A = 53.5^o$ (allow 53.4^o)

Hence bearing is 263^o **A1√** Obtain 263 or 264 (or 290^o – their angle C / 210 + their angle A)

4

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7 (a) $\int (x^5 - x^4 + 5x^3)\mathrm{d}x$ **M1** Expand brackets and attempt integration, or other valid integration attempt

$= \frac{1}{6}x^6 - \frac{1}{5}x^5 + \frac{5}{4}x^4$ $(+c)$ **A1** Obtain at least one correct term

A1 Obtain a fully correct expression

B1 For $+c$, and no $\int$ or $\mathrm{d}x$ (can be given in **(b)(i)** if not given here)

4

(b) (i) $-6x^{-3}$ $(+c)$ **M1** Obtain integral of the form kx^{-3}

A1 Obtain $-6x^{-3}$ $(+c)$

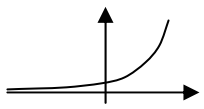
2

(ii) $\left[-6x^{-3}\right]_2^\infty$ **B1*** State or imply that $F(\infty) = 0$ (for kx^n, n -1)

$= ¾$ **B1d*** Obtain ¾ (or equiv)

2

8 (i)



M1 Attempt sketch of exponential graph (1st quad) - if seen in 2nd quad must be approx correct
A1 Correct graph in both quadrants
B1 State or imply (0, 2) only
3

(ii) $8^x = 2 \times 3^x$

$\log_2 8^x = \log_2 (2 \times 3^x)$ **M1** Form equation in x and take logs (to any consistent base, or no base) – could use $\log_8$

$x\log_2 8 = \log_2 2 + x\log_2 3$ **M1** Use $\log a^b = b \log a$
M1 Use $\log ab = \log a + \log b$,or equiv with $\log {}^a/_b$

$3x = 1 + x\log_2 3$ **M1** Use $\log_2 8 = 3$

$x(3 - \log_2 3) = 1$, hence $x = \dfrac{1}{3 - \log_2 3}$ **A.G.** **A1** Show given answer correctly

OR $8^x = 2 \times 3^x$

$2^{3x} = 2 \times 3^x$ **M1** Use $8^x = 2^{3x}$

$2^{(3x-1)} = 3^x$ **M1** Attempt to rearrange equation to $2^k = 3^x$

$\log_2 2^{(3x-1)} = \log_2 3^x$ **M1** Take logs (to any base)

$(3x - 1)\log_2 2 = x \log_2 3$ **M1** Use $\log a^b = b \log a$

$x(3 - \log_2 3) = 1$, hence $x = \dfrac{1}{3 - \log_2 3}$ **A.G.** **A1** Show given answer correctly

5

9 (a) (i) $2\sin x.\dfrac{\sin x}{\cos x} - 5 = \cos x$ **M1** Use $\tan x \equiv \dfrac{\sin x}{\cos x}$

$2\sin^2 x - 5\cos x = \cos^2 x$

$2 - 2\cos^2 x - 5\cos x = \cos^2 x$ **M1** Use $\sin^2 x \equiv 1 - \cos^2 x$

$3\cos^2 x + 5\cos x - 2 = 0$ **A1** Show given equation convincingly
3

(ii) $(3\cos x - 1)(\cos x + 2) = 0$ **M1** Attempt to solve quadratic in $\cos x$

$\cos x = {}^1/_3$ **M1** Attempt to find x from root(s) of quadratic

$x = 1.23$ rad **A1** Obtain 1.23 rad or 70.5°

$x = 5.05$ rad **A1√** Obtain 5.05 rad or 289° (or 2π / 360° - their solution)
SR: B1 B1 for answer(s) only
4

(b) $0.5 \times 0.25 \times \{\cos 0 + 2(\cos 0.25 + \cos 0.5 + \cos 0.75) + \cos 1\}$ **M1** Attempt y-coords for at least 4 of the correct 5 x-coords

M1 Use correct trapezium rule, any h, for their y values to find area between $x = 0$ and $x = 1$

M1 Correct h (soi) for their y values

≈ 0.837 **A1** Obtain 0.837
4

10 (i)	$u_{15} = 2 + 14 \times 0.5$ $= 9$ km	**M1** **A1** **2**	Attempt use of $a + (n-1)d$ Obtain 9 km
(ii)	$u_{20} = 2 \times 1.1^{19} = 12.2$ $u_{19} = 2 \times 1.1^{18} = 11.1$ ***OR***	**B1** **M1** **A1**	State, or imply, $r = 1.1$ Attempt u_{20} , using ar^{n-1} Obtain $u_{20} = 12.2$, and obtain $u_{19} = 11.1$
		B1 **M1** **A1** **3**	State, or imply, $r = 1.1$ Attempt to solve $ar^{n-1} = 12$ Obtain $n = 20$ (allow $n \geq 20$)
(iii)	$\frac{2(1.1^n - 1)}{(1.1-1)} > 200$ $1.1^n > 11$ $n > \frac{\log 11}{\log 1.1}$ $n > 25.2$ ie Day 26	**B1** **M1** **A1** **A1** **4**	State or imply $S_N = \frac{2(1.1^n - 1)}{(1.1-1)}$ Link (any sign) their attempt at S_N (of a GP) to 200 and attempt to solve Obtain 26, or 25.2 or better Conclude $n = 26$ only, or equiv eg Day 26
(iv)	swum = 2 x 30 = 60 km run = ½ x 30 x (4 + 29 x 0.5) $= 277.5$ km cycle = $\frac{2(1.1^{30} - 1)}{(1.1-1)}$ $= 329.0$ km total = 666 km	**B1** **M1** **M1** **A1** **4**	Obtain 60 km, or 2 x 30km Attempt sum of AP, $d = 0.5$, $a = 2$, $n = 30$ Attempt sum of GP, $r = 1.1$, $a = 2$, $n = 30$ Obtain 666 or 667 km