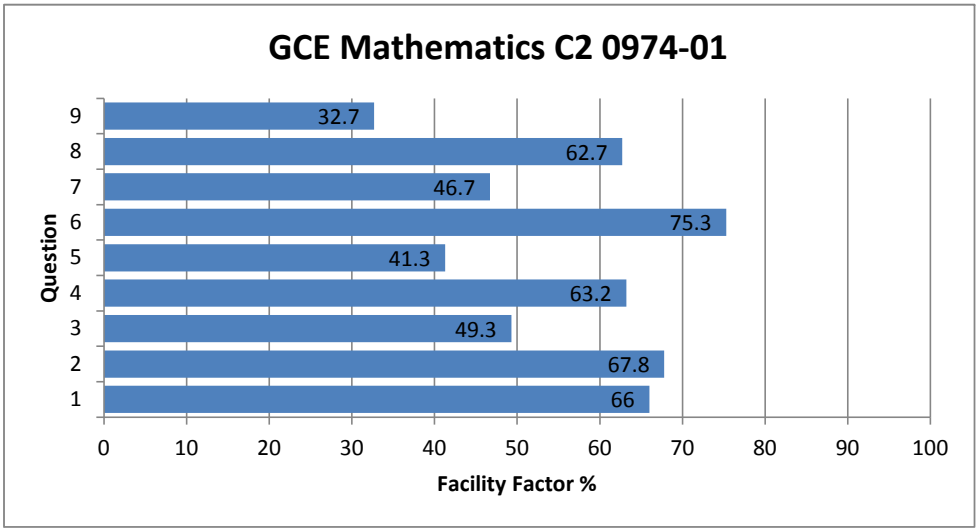
WJEC 2014 Online Exam Review

GCE Mathematics C2 0974-01

All Candidates' performance across questions

Question Title	N	Mean	S D	Max Mark	F F	Attempt %	
1	4944	3.3	1.5	5	66	98.7	
2	4917	8.1	3.5	12	67.8	98.1	2c
3	4829	3	2.2	6	49.3	96.4	
4	4914	6.3	3	10	63.2	98.1	
5	4703	3.3	2.3	8	41.3	93.8	5a
6	4862	9	3.5	12	75.3	97	
7	4707	2.8	1.8	6	46.7	93.9	7a
8	4728	6.3	3.3	10	62.7	94.3	
9	4383	2	2	6	32.7	87.5	



2. *(c)* Find all values of ϕ in the range $0° \leqslant \phi \leqslant 360°$ satisfying

$$\frac{7}{\cos\phi} - \frac{10}{\sin\phi} = 0.$$ [3]

Q2(c) $0 \rightarrow 360$

$\tan\phi = \frac{\sin\phi}{\cos\phi}$

$\frac{7}{\cos\phi} - \frac{10}{\sin\phi} = 0$

$\tan\cos\phi = \sin\phi$

$\frac{7}{\cos\phi} - 10 = \sin\phi$

$7 - 10 = (\tan\phi\cos\phi)\cos\phi$

$7 - 10 = \sin\phi \times \cos\phi$

$3 = \sin\phi\cos\phi$

Q2(c) $0 \rightarrow 360$

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~~$7 - 10 = (\tan\phi\cos\phi)\cos\phi$~~

$7 - 10 = \sin\phi \times \cos\phi$

$3 = \sin\phi\cos\phi$

2. (c)

$$\frac{7}{\cos\phi} - \frac{10}{\sin\phi} = 0$$

$$\frac{7}{\cos\phi} = \frac{10}{\sin\phi}$$

$$\frac{7\sin\phi}{\cos\phi} = 10$$

$$7\tan\phi = 10$$

$$7\phi = \tan^{-1}(10)$$

$$7\phi = 84.290^\circ, 264.29$$

$$\phi = 12.04^\circ, 37.76^\circ$$

$\therefore$ values of $\phi = 12.04^\circ, 37.76^\circ$

2. (c)

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$$\frac{7}{\cos\phi} = \frac{10}{\sin\phi}$$

$$\frac{7\sin\phi}{\cos\phi} = 10$$

M1 A0 A0

$$7\tan\phi = 10$$

$$7\phi = \tan^{-1}(10)$$

$$7\phi = 84.290^\circ, \ 264.29$$

$$\phi = 12.04^\circ, \ 37.76^\circ$$

$\therefore$ values of $\phi = 12.04^\circ, 37.76^\circ$

2. c) $\frac{7}{\cos\phi} - \frac{10}{\sin\phi} = 0$ $\quad 0^\circ \leq \phi \leq 360^\circ$

$7 - 10 = \cos\phi + \sin\phi$

$-3 = \sin\phi$

$-3 - \cos\phi = \sin\phi$

$-3 = \frac{\sin\phi}{\cos\phi}$

$= -71 \cdot 57^\circ$ (2.11.d)

2. c) $\frac{7}{\cos\phi} - \frac{10}{\sin\phi} = 0$ $\quad 0^\circ \leq \phi \leq 360^\circ$

$7 - 10 = \cos\phi + \sin\phi$

$-3 = \sin\phi$ ✗

$-3 - \cos\phi = \sin\phi$

$-3 = \frac{\sin\phi}{\cos\phi}$ ✗

$= -71 \cdot 57^\circ (2 \cdot 11 \cdot d)$

0

5. A geometric series has first term a and common ratio r. The sum of the second and third terms of the series is -216. The sum of the fifth and sixth terms of the series is 8.

(a) Prove that $r = -\frac{1}{3}$. [5]

ar^{n-1}

$S_n = \frac{a(1-r^n)}{1-r}$

$S_\infty = \frac{a}{1-r}$

(5) $a = ?$

$r = ?$

$2nd + 3rd = ar + ar^2 = -216 \rightarrow (1)$

$5^{th} + 6^{th} = ar^4 + ar^5 = 8 \rightarrow (2)$

(2) ÷ (1)

$\frac{ar^4 + ar^5 = 8}{ar + ar^2 = -216}$

$ar^4 + ar^5 = 8 \rightarrow (1)$

$ar + ar^2 = -216 \rightarrow (2)$

$= ar^3 + ar^3 = -\frac{1}{27}$

$2ar^3 = -\frac{1}{27}$

$ar^3 = \frac{-\frac{1}{27}}{2}$

$ar^3 = -\frac{1}{54}$

$ar^4 + ar^5 = 8 \Rightarrow \div 4 \Rightarrow a + ar = 4 \rightarrow (3)$

ar^{n-1}

$S_n = \frac{a(1-r^n)}{1-r}$

$S_\infty = \frac{a}{1-r}$

(5) $a = ?$

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$5^{th} + 6^{th} = ar^4 + ar^5 = 8 \rightarrow (2)$

(2) ÷ (1)

$\frac{ar^4 + ar^5 = 8}{ar + ar^2 = -216}$

$ar^4 + ar^5 = 8 \rightarrow (1)$

$ar + ar^2 = -216 \rightarrow (2)$

B1

B1

$= ar^3 + ar^3 = -\frac{1}{27}$

M0

$2ar^3 = -\frac{1}{27}$

A0

$ar^3 = \frac{-\frac{1}{27}}{2}$

A0

$ar^3 = -\frac{1}{54}$

$ar^4 + ar^5 = 8 \Rightarrow \div 4 \Rightarrow a + ar = 4 \rightarrow (3)$

5a.)

$U_2 + U_3 = -216$ $\quad$ $U_5 + U_6 = 8$

$ar + ar^2 = -216$ $\quad$ $ar^4 + ar^5 = 8$

$\frac{ar^4 + ar^5}{ar + ar^2} = \frac{8}{-216}$ $\quad$ $a(r + r^2) = -216$

$a(r^4 + r^5) = 8$

$\frac{a(r^4 + r^5)}{a(r + r^2)} = \frac{8}{-216}$ $\quad$ $\frac{r^9}{r^3} = \frac{8}{-216}$

$r^3 = \frac{8}{-216}$ $\quad$ $r^3 = \frac{-1}{27}$

$r = \sqrt[3]{\frac{8}{216}}$ $\quad$ $r = \sqrt[3]{\frac{8}{216}}$

$r = \frac{1}{3}$ $\quad$ $r = \sqrt[3]{\quad}$

$r = \frac{-1}{3}$

5a) Using

$u_2 + u_3 = -216$ ✓ $\quad u_5 + u_6 = 8$ ✓

$ar + ar^2 = -216$ $\quad ar^4 + ar^5 = 8$

~~$\frac{ar^4 + ar^5}{ar + ar^2} = \frac{8}{-216}$~~ $\quad a(r + r^2) = -216$

$a(r^4 + r^5) = 8$

$\frac{a(r^4 + r^5)}{a(r + r^2)} = \frac{8}{-216}$ $\quad \frac{r^9}{r^3} = \frac{8}{-216}$ ✗

B1

$r^3 = \frac{8}{-216}$ ✗ $\quad r^3 = \frac{-8}{216} = \frac{-1}{27}$

B1

$-r = \sqrt[3]{\frac{8}{216}}$ $\quad r = \sqrt[3]{\frac{-8}{216}}$

M0

$-r = \frac{1}{3}$ $\quad -r = \sqrt[3]{\quad}$

A0

A0

$r = \frac{-1}{3}$

5) a) $ar + ar^2 = -216$ (*) $\quad ar^4 + ar^5 = 8$

$a(r + r^2) = -216$ $\quad a(r^4 + r^5) = 8$

$a = \frac{-216}{(r + r^2)}$ ① $\quad a = \frac{8}{r^4 + r^5}$ ②

① = ②

$\frac{-216}{(r + r^2)} = \frac{8}{r^4 + r^5}$

$\times r \quad \frac{-216}{r} = \frac{8}{(r^3 + r^4)}$

$-216(r^3 + r^4) = 8r$

$\frac{-216(r^3 + r^4)}{r} = 8$

$-216(r^2 + r^3) = 8$

~~$-216r^2 - 216r^3 = 8$~~

~~$-216r - \sqrt{216}r^3 = \sqrt[3]{8}$~~

~~$-216r - 216 = \sqrt[3]{8}$~~

~~$-216(r + 1) = 2$~~

~~$r + 1 = 2/-216$~~

~~$r + 1 = -1/108$~~

~~$r =$~~

$r^2 + r^3 = 8/-216$

$r^2(1 + r) = -1/27$

$1/27 = -r^2(1 + r)$

$\frac{\sqrt{3}}{9} = -r(1 + r)$

$\frac{\sqrt{3}}{9} = -r - r^2$

$\frac{\sqrt{3}}{\sqrt{9}} = -2r$

$\frac{1}{3} = -r$

$r = -1/3$ QED

5) a) $ar + ar^2 = -216$ ✱ $ar^4 + ar^5 = 8$ ✓ B1

$a(r + r^2) = -216$ $a(r^4 + r^5) = 8$ B1

$a = \frac{-216}{(r + r^2)}$ ① $a = \frac{8}{r^4 + r^5}$ ②

① = ②

$\frac{-216}{(r + r^2)} = \frac{8}{r^4 + r^5}$

$\times r$ $\frac{-216}{r} = \frac{8}{(r^3 + r^4)}$

$-216(r^3 + r^4) = 8r$

$\frac{-216(r^3 + r^4)}{r} = 8$ M0

$-216(r^2 + r^3) = 8$

~~$-216r^2 - 216r^3 = 8$~~ $r^2 + r^3 = 8 / -216$

~~$-216r - \sqrt{216}r^3 = \sqrt[3]{8}$~~ $r^2(1 + r) = -1/27$ A0

~~$-216r - 216 = \sqrt[3]{8}$~~ $1/27 = -r^2(1 + r)$

~~$-216(r + 1) = 2$~~ $\frac{\sqrt{3}}{9} = -r(1 + r)$

~~$r + 1 = 2/216$~~ $\frac{\sqrt{3}}{9} = -r - r^2$

~~$r + 1 = -1/108$~~

~~$r =$~~ $\frac{\sqrt{3}}{\sqrt{9}} = -2r$ ✗

A0 $\frac{1}{3} = -r$

$r = -1/3$ QED

7. *(a)* Solve the equation

$$3^{\frac{5x}{4}-2} = 7.$$

Show your working and give your answer correct to three decimal places. [3]

7a) $\frac{3^{5/4x}}{3^2} = 7$

$3^{5/4x} = 7 \times 3^2$

$3^{5/4x} = 63$

$\log_3 63 = \frac{5}{4}x$

$x = \frac{(\log_3 63)}{5/4} \approx 3.017 \ (3dp)$

7a) $\frac{3^{5/4x}}{3^2} = 7$

$3^{5/4x} = 7 \times 3^2$

$3^{5/4x} = 63$

$\log_3 63 = \frac{5}{4}x$

$x = \frac{(\log_3 63)}{5/4} \approx 3.017 \ (3dp)$

(7a) Solve equation

$$3^{\frac{5x}{4}-2} = 7$$

logs both sides

$$\log 3^{\frac{5x}{4}-2} = \log 7$$

$$\left(\frac{5x}{4}-2\right)\log 3 = \log 7$$

$$\left(\frac{5x}{4}-2\right) = \frac{\log 7}{\log 3}$$

$$\frac{5x}{4} = \frac{\log 7}{\log 3} + 2$$

$$5x = \frac{\log 7}{\log 3} + 2(4)$$

$$x = \frac{\frac{\log 7}{\log 3} + 2(4)}{5}$$

$$x = 1.9542475$$

$$x = 1.954 \text{ (3dp)}$$

(7a) Solve equation

$$3^{\frac{5x}{4}-2} = 7$$

logs both sides

$$\log 3^{\frac{5x}{4}-2} = \log 7$$

$$\left(\frac{5x}{4}-2\right)\log 3 = \log 7$$

$$\left(\frac{5x}{4}-2\right) = \frac{\log 7}{\log 3}$$

$$\frac{5x}{4} = \frac{\log 7}{\log 3} + 2 \quad \checkmark$$ **M1**

A1

$$5x = \frac{\log 7}{\log 3} + 2(4)$$

$$x = \frac{\frac{\log 7}{\log 3} + 2(4)}{5} \quad \times$$ **A0**

$$x = 1.954248755$$

$$x = 1.954 \text{ (3dp)} \quad \times$$

Leave blank

7)

a) $3^{\frac{5x}{4}-2} = 7$

$\left(\frac{5x}{4}-2\right)\log_a 3 = \log_a 7$

$\left(\frac{5x-2}{4}\right) = \frac{\log_a 7}{\log_a 3}$

$\left(\frac{5x-2}{4}\right) = 1.771 \text{ (3dp)}$

$5x-2 = 7.084$

$5x = 9.084$

$x = \frac{9.084}{5}$

$x = 1.817 \text{ (3dp)}$

Leave blank

7)

a) $3^{\frac{5x}{4}-2} = 7$ ✓

M1

$\left(\frac{5x}{4}-2\right)\log_a 3 = \log_a 7$ ✓

$\left(\frac{5x-2}{4}\right) = \frac{\log_a 7}{\log_a 3}$

A0

$\left(\frac{5x-2}{4}\right) = 1.771 \text{ (3dp)}$

$5x-2 = 7.084$

$5x = 9.084$

A0

$x = \frac{9.084}{5}$ ✗

$x = 1.817 \text{ (3dp)}$