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SEMESTER ONE

MATHEMATICS METHODS UNITS 1

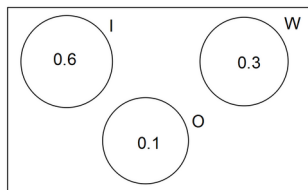
2017

SOLUTIONS

Calculator-free Solutions

1. (a) (i) $P \cap Q$ ✓
 (ii) $M \cap (L \cup N)$ or $(L \cap M) \cup (M \cap N)$ ✓
 (b) (i) $A \cap B \cap C = \{3\}$ ✓
 (ii) $(A \cup B)' = \{8, 9, 10, 14, 15, 16, 18, 19\}$ ✓
 (iii) $n(B \cup C) = 8$ ✓ [5]
2. (a) (i) $x^2 + y^2 = 13$ ✓✓
 (ii) $y = -\frac{6}{x}$ ✓✓
 (iii) $y = -x - 1$ ✓✓
 (b) $x = -3, -2, 2, 3$ ✓✓
 (c) (i) $(-\frac{3}{2}, 3)$ ✓✓
 (ii) $m = -2$ ✓ [11]
3. $(x - 1)^2 + (y - 1)^2 = 25$ ✓
 Centre (1, 1)
 $\frac{4 + x}{2} = 1$ $\frac{5 + y}{2} = 1$ ✓
 M (-2, -3) ✓✓ [4]
4. (a) $\sin 225^\circ$ ✓
 $= -\sin 45^\circ$
 $= -\frac{\sqrt{2}}{2}$ ✓
 (b) $\tan\left(\frac{3\pi}{12} + \frac{4\pi}{12}\right) = \tan\left(\frac{\pi}{4} + \frac{\pi}{3}\right)$ ✓
 $\frac{\tan \frac{\pi}{4} + \tan \frac{\pi}{3}}{1 - \left(\tan \frac{\pi}{4}\right)\left(\tan \frac{\pi}{3}\right)}$ ✓
 $= \frac{1 + \sqrt{3}}{1 - \sqrt{3}}$ ✓
 $= -2 - \sqrt{3}$ ✓ [6]
5. (a) $A = \frac{1}{2}(x)(x + 3)(\sin 60)$ ✓
 $= \frac{x}{2}(x + 3)\left(\frac{\sqrt{3}}{2}\right)$ ✓
 $= \frac{x}{4}(\sqrt{3}x + 3\sqrt{3}) \text{ cm}^2$
 (b) $x^2 + (x + 3)^2 - 2(x)(x + 3)(\cos 60) = 49$ ✓
 $x^2 + 3x - 40 = 0$ ✓
 $(x + 8)(x - 5) = 0$ ✓
 $(x = -8 \text{ discard}) \therefore x = 5$ ✓
 (c) $A = \frac{5\sqrt{3}}{4}(5 + 3)$ ✓
 $10\sqrt{3} \text{ cm}^2$ ✓ [7]

6. (a) 60% ✓
 (b) 40% ✓
 (c) 70% ✓
 (d)



Or

I	0.6	W	0.3
		O	0.1

✓✓

[5]

7. (a) $4 \cos(x) - 2 = -4 \sin\left(x - \frac{\pi}{2}\right) - 2$
 $a = 4 \quad b = 2 \quad c = -4 \quad d = \frac{\pi}{2} \text{ or } c = 4 \quad d = -\frac{\pi}{2}$
 (b) $R_{k(x)} = \{y : -6 \leq y \leq 2, y \in \mathbb{R}\}$
 (c) For every x value there is only one y value
 Vertical line through graph

✓✓✓✓

✓✓

✓

✓

[8]

8. (a) $\theta = 210^\circ$ or 330°

✓✓

(b) $\cos^2 \theta = \frac{3}{4}$

$\cos \theta = \pm \frac{\sqrt{3}}{2}$

✓

$\theta = \frac{\pi}{6}, \frac{11\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}$

✓✓

[5]

Calculator-assumed Solutions

9. (a) (i) $V = \frac{k}{P}$
 $k = 2.84 \times 11.5$
 $k = 32.66$
 (ii) The volume doubles.
 (b) $s = 0.0325c$ is a linear relationship in the form $y = kx$ where $k = 0.0325$ and is therefore directly proportional.

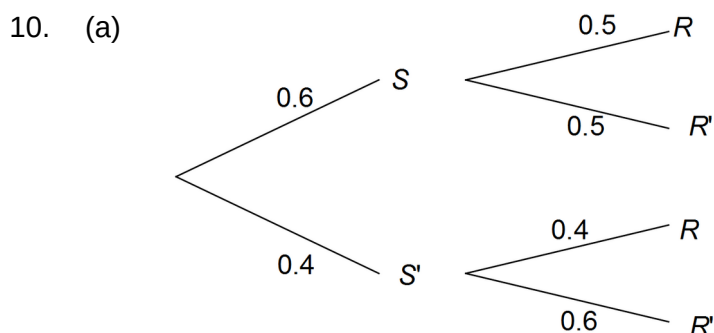
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✓

✓

✓✓

[5]



- (b) (i) 0.3
 (ii) 0.24
 (iii) 0.46

✓✓✓

✓

✓

✓✓

(iv) 0.348 or $\frac{16}{46}$

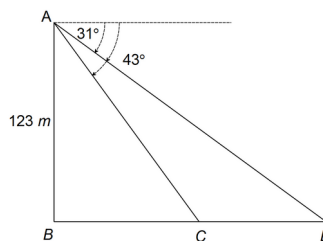
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[9]

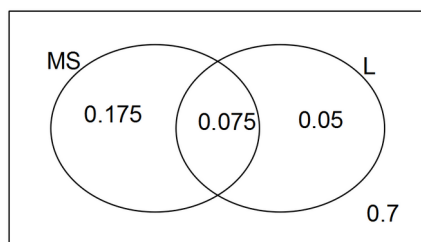
11. (a) $y = 4 + b$ ✓
 (b) $(0, -c - 2)$ ✓✓
 (c) $\{x : x \neq a - 3; x \in \mathbb{R}\}$ ✓✓ [5]

12. (a) $\sin \theta = -\frac{\sqrt{161}}{15}$ ✓
 $\cos 2\theta = (\cos \theta)(\cos \theta) - (\sin \theta)(\sin \theta)$ ✓
 $= \frac{64}{225} - \frac{161}{225}$ ✓
 $= -\frac{97}{225}$ ✓

(b) $AC = \frac{123}{\sin 43^\circ}$ ✓
 $\angle CAD = 12^\circ$ and $\angle ADC = 31^\circ$ ✓
 $\frac{CD}{\sin 12^\circ} = \frac{AC}{\sin 31^\circ}$ ✓
 $\therefore CD = AC \frac{\sin 12^\circ}{\sin 31^\circ}$ ✓
 $= \frac{123}{\sin 43^\circ} \times \frac{\sin 12^\circ}{\sin 31^\circ}$ ✓
 $= 73 \text{ m}$ ✓

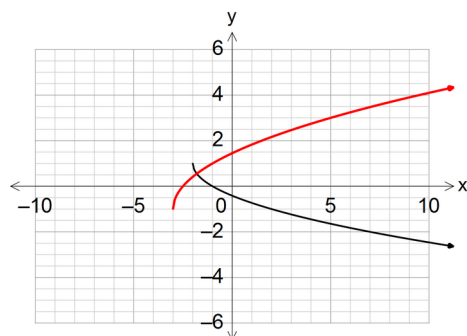


13. (a)



- (b) 0.075 ✓✓✓
 (c) $\frac{133}{0.075} = 0.6$ ✓
 (d) 0.125 ✓✓
 (e) $P(MS \cap L) = P(MS) \times P(L)$ to be independent. ✓
 $0.075 \neq 0.25 \times 0.125$ ✓
 Therefore not independent or $P(M | L) \neq P(M) \therefore$ Not independent ✓ [9]

14. (a) (i) 3 ✓
 (ii) 0 ✓
 (iii) 1 ✓
 (b) Domain of $p(x)$ is the same as $m(x)$. For both: $x \geq 0, x \in \mathbb{R}$ ✓✓
 (c) $q(x) = -\sqrt{x+2} + 1$ ✓✓
 (d)



✓✓✓

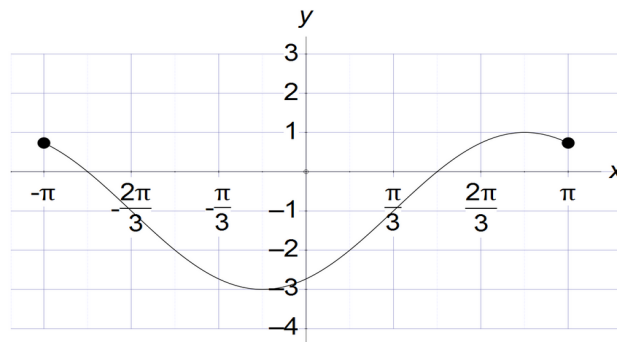
[10]

15. (a) $-x^2 + 3x + 4 = 2x + q$ ✓
 $-x^2 + x + 4 - q = 0$ ✓
 $b^2 - 4ac = 0$ for one solution
 $\therefore 17 - 4q = 0$ ✓
 $\therefore q = \frac{17}{4}$ ✓
 (b) $17 - 4q < 0$ ✓
 $\therefore q > \frac{17}{4}$ ✓ [6]
16. (a) $100^2 = 80^2 + 80^2 - 2(80)(80)\cos A$
 $\angle A = 77.3644^\circ$ or $\angle A = 1.3503^R$ ✓
 $\text{Area} = \frac{1}{2}(80)(80)\sin 77.3644^\circ$ ✓
 $= 3122.4993 \text{ cm}^2$ ✓
 $\angle BCA = \angle ABC = 0.8957^R$ ✓
 (b) $\text{Area of sector} = \frac{1}{2}(50^2)(0.89566)$
 $= 1119.56 \text{ cm}^2$ ✓
 $\text{Area of small sector} = \frac{1}{2}(30^2)(1.3503)$
 $= 607.635 \text{ cm}^2$ ✓
 $\text{Area of shaded section} = 3122.4993 - (2)(1119.58) - (607.635)$
 $= 275.704$
 $= 276 \text{ cm}^2$ ✓ [7]
17. (a) (i) $8 \times 7 \times 6 \times 5 \times 4 = 6720$ ✓✓
 $\frac{1}{6720} = 0.00015$ ✓
 (ii) ${}^4C_0 a^4 + {}^4C_1 a^3 b + {}^4C_2 a^2 b^2 + {}^4C_3 a b^3 + {}^4C_4 b^4$ ✓✓
 (b) (i) ${}^7C_3 (2x)^4 (-y)^3 = -560x^4 y^3$ ✓✓
 (ii) ${}^5C_3 \times {}^6C_2 = 150$ ✓
 (c) (i) $({}^6C_4 \times {}^5C_1) + ({}^6C_5 \times {}^5C_0) = 81$ ✓✓ [10]
 (ii) $({}^6C_4 \times {}^5C_1) + ({}^6C_5 \times {}^5C_0) = 81$ ✓✓
18. (a) $\tan 122^\circ = -1.6$
 $y = -1.6x + c$ ✓
 $5.2 = (-2)(-1.6) + c$
 $c = 2$
 $y = -1.6x + 2$ ✓
 (b) $2\left(x^2 - \frac{3}{2}x - \frac{1}{2}\right) = y$
 $2\left(\left(x - \frac{3}{4}\right)^2 - \frac{17}{16}\right) = y$ ✓
 $2\left(x - \frac{3}{4}\right)^2 - \frac{17}{8} = y$ ✓
 Turning Point $\left(\frac{3}{4}, -\frac{17}{8}\right)$ ✓

- | | | | | |
|-----|-------|------------------------|----|-----|
| (c) | (i) | 1 m | ✓ | |
| | (ii) | 5.5m | ✓ | |
| | (iii) | 1.77 m or 28.23 m away | ✓✓ | [9] |

19. (a) $y = 2 \sin \left(x - \frac{\pi}{3} \right) - 1$
 (b)

✓✓



✓✓✓

(c) $x = -\frac{2\pi}{3}$ or $\frac{\pi}{3}$

✓

[6]

20. (a)

	H	H'	
G	0.4	0.3	0.7
G'	0.2	0.1	0.3
	0.6	0.4	1

✓✓✓

- (b) (i) 0.3
 (ii) 0.6
 (iii) 0.1
 (iv) 0.9
 (v) $\frac{2}{3}$

✓

✓

✓

✓

✓

✓✓

- (c) Not mutually exclusive: $P(G \cap H) = 0.4$ Should be 0

✓

[10]

21. (a) $C \left(\frac{3}{2}, \frac{5}{2} \right) \quad r = 3$

✓✓

- (b) (i) $y = -(x + a)(x - b)^2$
 (ii) $y = x(x + a)(x - b)$
 (iii) $y = (x - a)^3 + b$

✓

✓

✓

[5]

End of Questions

