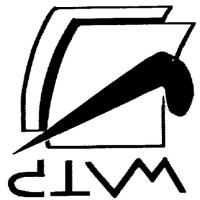


# SOLUTIONS

2017

MATHEMATICS  
METHODS  
UNITS 1

SEMESTER ONE

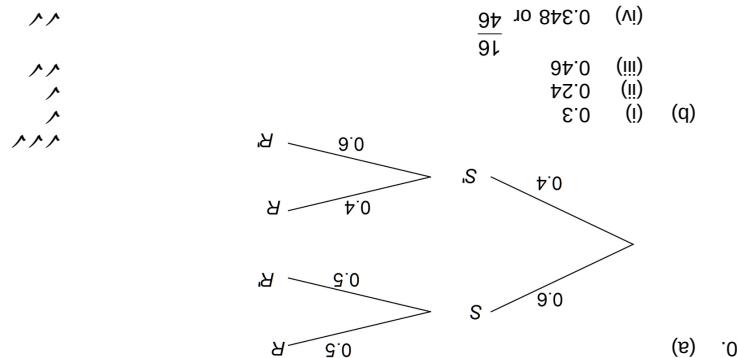


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**Calculator-free Solutions**

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)  $(-\frac{3}{2}, \frac{3}{2})$  ✓✓  
          (ii)  $m = -2$  ✓ [11]
3.  $(x - 1)^2 + (y - 1)^2 = 25$  ✓  
    Centre  $(1, 1)$   
 $\frac{4+x}{2} = 1 \quad \frac{5+y}{2} = 1$  ✓  
 $M(-2, -3)$  ✓✓ [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]

[9]



[5]

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

[5]

#### Calculator-assumed Solutions

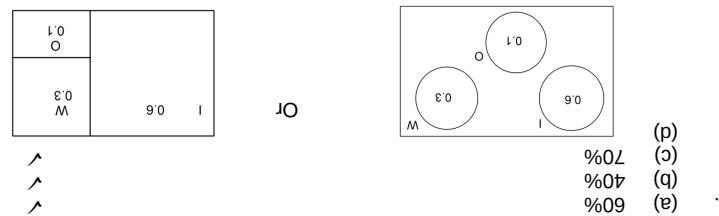
[5]

$$\begin{aligned} \theta &= \frac{\pi}{6}, \frac{6\pi}{7}, \frac{6\pi}{5} \\ \cos \theta &= \pm \frac{\sqrt{3}}{2} \\ (\text{b}) \quad \cos^2 \theta &= \frac{3}{4} \\ 8. \quad (\text{a}) \quad \theta &= 210^\circ \text{ or } 330^\circ \end{aligned}$$

[8]

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

[5]







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  $\angle A = 1.3503^R$  ✓

Area =  $\frac{1}{2}(80)(80)\sin 77.3644^\circ$  ✓  
=  $3122.4993 \text{ cm}^2$  ✓

(b)  $\angle BCA = \angle ABC = 0.8957^R$  ✓

Area of sector =  $\frac{1}{2}(50^2)(0.89566)$  ✓  
=  $1119.56 \text{ cm}^2$  ✓

Area of small sector =  $\frac{1}{2}(30^2)(1.3503)$  ✓  
=  $607.635 \text{ cm}^2$  ✓

Area of shaded section =  $3122.4993 - (2)(1119.58) - (607.635)$  ✓  
=  $275.704$  ✓  
=  $276 \text{ cm}^2$  ✓ [7]

17. (a) (i)  $8 \times 7 \times 6 \times 5 \times 4 = 6720$  ✓✓  
(ii)  $\frac{1}{6720} = 0.00015$  ✓

(b) (i)  ${}^4\mathbf{C}_0 a^4 + {}^4\mathbf{C}_1 a^3 b + {}^4\mathbf{C}_2 a^2 b^2 + {}^4\mathbf{C}_3 a b^3 + {}^4\mathbf{C}_4 b^4$  ✓✓  
(ii)  ${}^7\mathbf{C}_3 (2x)^4 (-y)^3 = -560x^4 y^3$  ✓✓

(c) (i)  ${}^5\mathbf{C}_3 \times {}^6\mathbf{C}_2 = 150$  ✓  
(ii)  $({}^6\mathbf{C}_4 \times {}^5\mathbf{C}_1) + ({}^6\mathbf{C}_5 \times {}^5\mathbf{C}_0) = 81$  ✓✓ [10]

18. (a)  $\tan 122^\circ = -1.6$   
 $y = -1.6x + c$  ✓  
 $5.2 = (-2)(-1.6) + c$   
 $c = 2$

(b)  $y = -1.6x + 2$  ✓  
 $2\left(x^2 - \frac{3}{2}x - \frac{1}{2}\right) = y$

$2\left(\left(x - \frac{3}{4}\right)^2 - \frac{17}{16}\right) = y$  ✓

$2\left(x - \frac{3}{4}\right)^2 - \frac{17}{8} = y$  ✓

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]