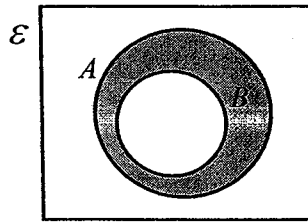




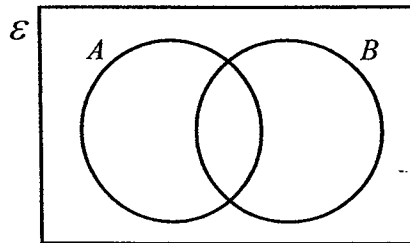
## Part 1 (40 marks)

- 1 (a) Express, in set notation, the set represented by the shaded area in terms of  $A$  and  $B$ .



Answer (a) ..... [1]

- (b) On the Venn diagram shown in the answer space, shade the set  $(A \cup B)' \cup (A \cap B)$ .



[1]

- 2 Some students were asked how long they spent on the internet every day. The table shows the result.

Number of hours	0	1	2	3	4	5
Number of students	6	5	10	12	6	$x$

- (a) It is given that the mode is 3. Write down the largest possible value of  $x$ .
- (b) It is given that the median is 3. Write down the smallest possible value of  $x$ .

Answer (a) ..... [1]

(b) ..... [1]

- 3 It is given that  $n(\mathcal{E}) = 100$ ,  $n(A) = 50$  and  $n(B) = 36$ , find

- (a) the greatest possible value of  $n(A \cap B)$ ,
- (b) the least possible value of  $n(A \cup B)$ .

Answer (a) ..... [1]

(b) ..... [1]

4 Simplify  $\frac{(3a^3bc)^3}{27bc^4} \times \frac{9a}{8b} \div \frac{3b}{4a^4c}$ .

Answer ..... [3]

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5 Solve the simultaneous equations

$$\frac{3}{x+1} + \frac{2}{y-2} = 7,$$
$$\frac{9}{x+1} + \frac{8}{y-2} = 22.$$

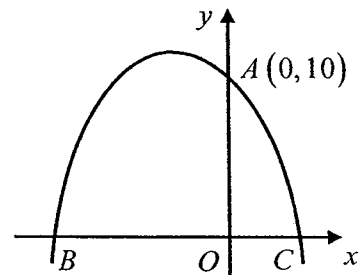
Answer  $x = \dots\dots\dots$ ,  $y = \dots\dots\dots$  [3]

6 It is given that  $y = \sqrt[3]{\frac{2q(x^2-8)}{p}}$ , express  $x$  in terms of  $y$ ,  $p$  and  $q$ .

Answer ..... [4]

7 The graph of  $y = (x+h)(2-x)$ , where  $h$  is a constant, cuts the  $x$ -axis at  $B$  and  $C$ . It cuts the  $y$ -axis at  $A(0, 10)$ .

- (a) Show that the value of  $h$  is 5.
- (b) Write down the coordinates of  $B$ .
- (c) A line parallel to  $AB$  passes through  $C$ . Find the equation of this line.



Answer (a) ..... [1]

.....

.....

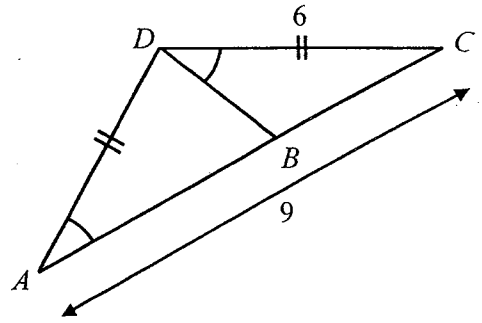
.....

Answer (b)  $B$  ( ..... , ..... ) [1]

(c) ..... [3]

- 8 In the diagram,  $\angle CDB = \angle CAD$ ,  $AD = CD = 6$  cm and  $AC = 9$  cm.

- (a) Name a pair of similar triangles.  
 (b) Find the ratio  $BC : CD$ .  
 (c) Calculate  $AB$ .



Answer (a)  $\Delta$  ..... and  $\Delta$  ..... [1]

(b) ..... : ..... [1]

(c) ..... cm [2]

- 9 (a) The lines  $y = 2(k+3)x + 10$  and  $6y + (k+1)x - 4 = 0$  are parallel. Find the value of  $k$ .  
 (b) The line  $3y = mx + n$  passes through the points  $(-5, 6)$  and  $(2, 13)$ . Find the value of  $m$  and of  $n$ .

Answer (a)  $k =$  ..... [2]

b)  $m =$  ..... ,  $n =$  ..... [3]

10 Factorise completely

(a)  $4p^2 - 14p + 12$  ,

(b)  $(2x+3)^2 - (x-5)^2$ .

Answer (a) ..... [2]

(b) ..... [2]

11 (a)  $y$  is directly proportional to  $x^3$ . It is known that  $y = 5$  for a particular value of  $x$ . Find the value of  $y$  when this value of  $x$  is halved.

(b) 12 workers can build a house in 52 days.

(i) Find the number of days required by 8 workers to build the same house.

(ii) Find the number of additional workers needed in order for the house to be completed in 24 days.

Answer (a)  $y =$  ..... [2]

(b) (i) ..... days [2]

(ii) ..... additional workers [2]

*End of Part I*

## Part 2 (60 marks)

- 1 (a)  $\varepsilon = \{x : x \text{ is a natural number and } x < 10\}$ ,  
 $P = \{x : x \text{ is a prime number}\}$ ,  
 $Q = \{x : x \text{ is an odd number}\}$ .

(i) Find  $n(P \cap Q)$ . [1]

(ii) Find  $(P \cup Q)'$ . [1]

- (b) It is given that  $\varepsilon = \{\text{all students in a class}\}$ ,  $B = \{\text{boys in the class}\}$ ,  
 $K = \{\text{students who like kayaking}\}$ ,  $S = \{\text{students who like sailing}\}$ .

Describe each of the following sets in words.

(i)  $K \cap S \neq \emptyset$  [1]

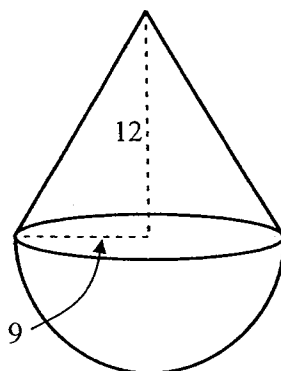
(ii)  $B \subset S$  [1]

Express each of the following statements in set notation

(iii) No boys like kayaking. [1]

(iv) All girls in the class like either kayaking or sailing or both. [1]

- 2 [The value of  $\pi$  is 3.142 correct to three decimal places]



The diagram shows a metal toy made from a cone and a hemisphere. The cone and the hemisphere both have a radius of 9 cm. The cone has a height of 12 cm.

Calculate

(a) the surface area of the toy, [4]

(b) the volume of the toy. [3]

- 3 (a) Express  $\frac{1}{x+3} + \frac{3x-2}{3x^2+7x-6} - \frac{3}{9-x^2}$  as a single fraction in its simplest form. [4]
- (b) A forest with an area of  $0.49 \text{ km}^2$  is represented by an area of  $0.25 \text{ cm}^2$  on a map. The area of a lake is  $4 \text{ cm}^2$  on the same map. Find the area, in  $\text{cm}^2$ , of the lake drawn on a second map with a scale of 1 : 250 000. [3]

- 4 (a) The measurements of the breaking strength, in grams, of a sample of 20 threads are:

192	240	224	211	226
203	210	212	233	224
233	211	214	212	231
207	241	203	221	212

- (i) Construct a stem and leaf diagram to represent the above data. [3]
- (ii) Find the mode and median breaking strength of the threads. [2]
- (b) The masses of some football players are given in the table below.

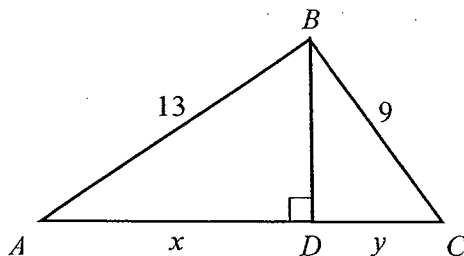
Mass in kg	Frequency, $f$	Mid-value, $x$	$fx$
$64 < m \leq 66$	6		
$66 < m \leq 68$	15		
$68 < m \leq 70$	11		
$70 < m \leq 72$	10		
$72 < m \leq 74$	8		
	$\Sigma f =$		$\Sigma fx =$

- (i) Copy and complete the table. [3]
- (ii) Calculate the mean mass of the football players. [1]
- (iii) A player is chosen at random. Calculate the probability that his mass is greater than 70 kg. Express your answer as a fraction in its lowest terms. [1]



- 5 A delivery van travels its entire 80 km journey at an average speed of  $x$  km/h.
- (a) Write down an expression, in terms of  $x$ , for the time taken, in hours, to travel its journey. [1]
- (b) On a certain day, due to heavy traffic, the delivery van was delayed and took 30 minutes longer than scheduled to travel the first 20 km. The remainder of the journey was completed at an average speed of  $(x + 20)$  km/h.
- Write down an expression, in terms of  $x$ , for the time taken, in hours, to travel
- (i) the first 20 km, [1]
- (ii) the remaining journey. [1]
- (c) On the day of delay, the delivery van managed to arrive at its destination on time.
- (i) Write down an equation in  $x$ , and show that it reduces to  $x^2 + 20x - 2400 = 0$ . [3]
- (ii) Solve the equation  $x^2 + 20x - 2400 = 0$ . [2]
- (iii) Find the time taken for the normal scheduled journey. [1]

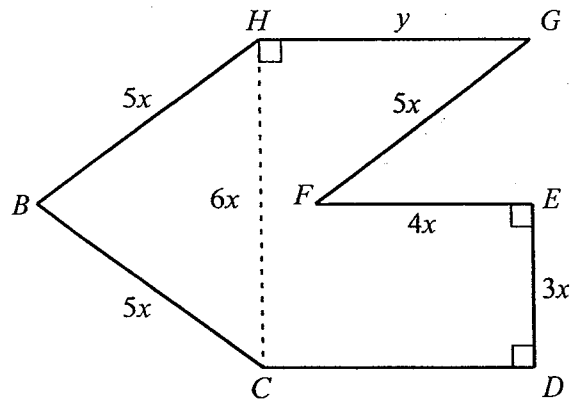
6 (a)



In the diagram,  $AB = 13$  cm,  $BC = 9$  cm,  $AD = x$  cm,  $CD = y$  cm and angle  $ADB = 90^\circ$ .  $ADC$  is a straight line.

- (i) Show that  $x^2 - y^2 = 88$ . [3]
- (ii) It is given that  $AC = 16$  cm, find the value of  $x - y$ . [2]
- (b) A bag contains 90 balls of which some are green, some are blue and the rest are yellow. The probabilities of drawing a green ball and a blue ball are  $\frac{7}{18}$  and  $\frac{4}{9}$  respectively.
- (i) Find the number of yellow balls. [2]
- (ii) It is given that  $x$  blue balls are removed from the bag and the probability of drawing a blue ball from the remaining balls becomes  $\frac{7}{17}$ . Find  $x$ . [3]

7 Answer the whole of this question on a sheet of graph paper.



A 100 m wire is bent to form the above shape. It is given that  $HG = y$  m,  $HC = 6x$  m,  $HB = BC = GF = 5x$  m,  $EF = 4x$  m,  $DE = 3x$  m and  $HCDG$  is a rectangle.

- (a) Find  $y$  in terms of  $x$ . [2]
- (b) Show that the enclosed area,  $A$ , in  $\text{m}^2$ , of the shape is given by  $A = 300x - 60x^2$ . [2]
- (c) The following table shows some values of  $x$  and the corresponding values of  $A$  where  $A = 300x - 60x^2$ .

$x$	0	0.5	1	2	3	4
$A$	0	$p$	240	360	360	240

- (i) Find the value of  $p$ . [1]
- (ii) Using a scale of 2 cm to represent 0.5 m, draw a horizontal  $x$ -axis for  $0 \leq x \leq 4$ . Using a scale of 2 cm to represent 50 square metres, draw a vertical  $A$ -axis for  $0 \leq A \leq 400$ . On your axes, plot the points given in the table and join them with a smooth curve. [3]

Use your graph to find

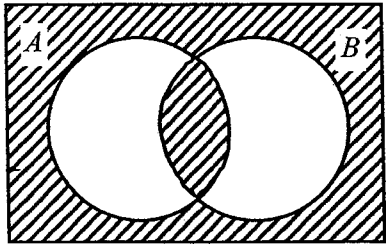
- (iii) the values of  $x$  when  $A = 250 \text{ m}^2$ , [2]
- (iv) the value of  $x$  for which the area of the shape is greatest. [1]

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*End of Part II*

# 2010 VICTORIA SCHOOL SEC 2 SA2 Answer Key

## Part 1

1a	$A \cap B'$	9a	$k = -2\frac{11}{13}$
1b	$\mathcal{E}$ 	9b	$m = 3, n = 33$
2a	11	10a	$2(2p-3)(p-2)$
2b	4	10b	$(3x-2)(x+8)$
3a	36	11a	$y = \frac{5}{8}$
3b	14	11b(i)	78
4	$\frac{3a^{14}}{2}$	11b(ii)	14
5	$x = -\frac{1}{2}$ and $y = 4$		
6	$x = \pm \sqrt{\frac{py^3}{2q} + 8}$		
7a	$2h = 10 \therefore h = 5$		
7b	$B(-5, 0)$		
7c	$y = 2x - 4$		
8a	$\triangle DAC$ and $\triangle BDC$ or $\triangle BCD$		
8b	$BC : CD = 2 : 3$		
8c	$AB = 5 \text{ cm}$		

## 2010 VICTORIA SCHOOL SEC 2 SA2 Answer Key

### Part 2

1a(i)	$n(P \cap Q) = 3$	5a	$\frac{80}{x}$																												
1a(ii)	$(P \cup Q)' = \{4, 6, 8\}$	—	—																												
1b(i)	There are some students who like kayaking and sailing.	5b(i)	$\frac{20}{x} + \frac{1}{2}$ 5b(ii) $\frac{60}{x+20}$																												
1b(ii)	All boys in the class like sailing.	5c(i)	$\frac{20}{x} + \frac{1}{2} + \frac{60}{x+20} = \frac{80}{x}$																												
1b(iii)	$B \cap K = \emptyset$	5c(ii)	$x = -60$ (n.a) $x = 40$																												
1b(iv)	$B' \subset (K \cup S)$ or $B' \subseteq (K \cup S)$	5c(iii)	2 hrs																												
2a	$933.174 \text{ cm}^2$	6a(i)	$BD^2 = 13^2 - x^2$ $BD^2 = 9^2 - y^2$ Hence, $13^2 - x^2 = 9^2 - y^2$ $x^2 - y^2 = 13^2 - 9^2$ $\therefore x^2 - y^2 = 88$ (shown)																												
2b	$2545.02 \text{ cm}^2$	6a(ii)	$x - y = 5.5$																												
3a	$\frac{2x-3}{(x+3)(x-3)}$ or $\frac{3-2x}{(x+3)(3-x)}$	6b(i)	15																												
3b	$1.2544 \text{ cm}^2$	6b(ii)	$x = 5$																												
4a(i)	<table border="1"> <thead> <tr> <th>Stem</th> <th>Leaf</th> </tr> </thead> <tbody> <tr> <td>19</td> <td>2</td> </tr> <tr> <td>20</td> <td>3 3 7</td> </tr> <tr> <td>21</td> <td>0 1 1 2 2 2 2 4</td> </tr> <tr> <td>22</td> <td>1 4 4 6</td> </tr> <tr> <td>23</td> <td>1 3 3</td> </tr> <tr> <td>24</td> <td>0 1</td> </tr> </tbody> </table>	Stem	Leaf	19	2	20	3 3 7	21	0 1 1 2 2 2 2 4	22	1 4 4 6	23	1 3 3	24	0 1	7a	$2(5x) + 2y + 3x + 4x + 5x = 100$ $\therefore y = 50 - 11x$														
Stem	Leaf																														
19	2																														
20	3 3 7																														
21	0 1 1 2 2 2 2 4																														
22	1 4 4 6																														
23	1 3 3																														
24	0 1																														
4a(ii)	Mode = 212 g	7b	area of shape, $A$ $= \frac{1}{2}(6x)(4x) + 6xy - \frac{1}{2}(4x)(3x)$ $= 300x - 60x^2$ (shown)																												
4a(iii)	Median = 213 g	7c(i)	$p = 135$																												
4b(i)	<table border="1"> <thead> <tr> <th>Mass (kg)</th> <th><math>f</math></th> <th>Mid-value, <math>x</math></th> <th><math>fx</math></th> </tr> </thead> <tbody> <tr> <td><math>64 &lt; m \leq 66</math></td> <td>6</td> <td>65</td> <td>390</td> </tr> <tr> <td><math>66 &lt; m \leq 68</math></td> <td>15</td> <td>67</td> <td>1005</td> </tr> <tr> <td><math>68 &lt; m \leq 70</math></td> <td>11</td> <td>69</td> <td>759</td> </tr> <tr> <td><math>70 &lt; m \leq 72</math></td> <td>10</td> <td>71</td> <td>710</td> </tr> <tr> <td><math>72 &lt; m \leq 74</math></td> <td>8</td> <td>73</td> <td>584</td> </tr> <tr> <td></td> <td><math>\Sigma f = 50</math></td> <td></td> <td><math>\Sigma fx = 3448</math></td> </tr> </tbody> </table>	Mass (kg)	$f$	Mid-value, $x$	$fx$	$64 < m \leq 66$	6	65	390	$66 < m \leq 68$	15	67	1005	$68 < m \leq 70$	11	69	759	$70 < m \leq 72$	10	71	710	$72 < m \leq 74$	8	73	584		$\Sigma f = 50$		$\Sigma fx = 3448$	7c(ii)	From the graph, when $A = 250$ , $x = 1.05$ or $x = 3.95$
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4b(ii)	$68.96 \text{ kg}$	7c(iii)	From the graph, Max/greatest area occurs when $x = 2.5$																												
4b(iii)	$68.96 \text{ kg}$	4b(iv)	$\frac{9}{25}$																												