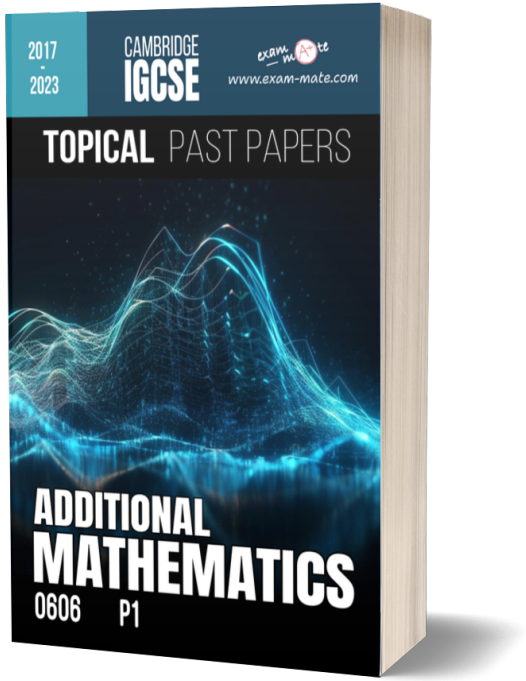
ADDITIONAL MATHEMATICS

0606 P2

2017 - 2023
QUESTIONS+ANSWERS

Chapter 1	Sets	Page 1
Chapter 2	Intersection Points	Page 9
Chapter 3	Surds, Indices & Logarithm	Page 40
Chapter 4	Factor Theorem	Page 103
Chapter 5	Matrices	Page 123
Chapter 6	Geometry Coordinate	Page 133
Chapter 7	Linear Law	Page 148
Chapter 8	Functions	Page 159
Chapter 9	Trigonometry	Page 219
Chapter 10	Circular Measure	Page 264
Chapter 11	Permutation & Combination	Page 277
Chapter 12	Binomial Theorem	Page 297
Chapter 13	Differentiation	Page 313
Chapter 14	Integration	Page 401
Chapter 15	Kinematics	Page 449
Chapter 16	Vectors	Page 465
Chapter 17	Relative Velocity	Page 484
Chapter 18	**Sequences & Series**	Page 490
	ANSWERS	Page 507



ADDITIONAL MATHEMATICS 0606

TOPICAL PAST PAPER WORKSHEETS

2017 - 2023 | Questions + Mark scheme

AVAILABLE PAPERS

P1
471 Questions

P2
478 Questions

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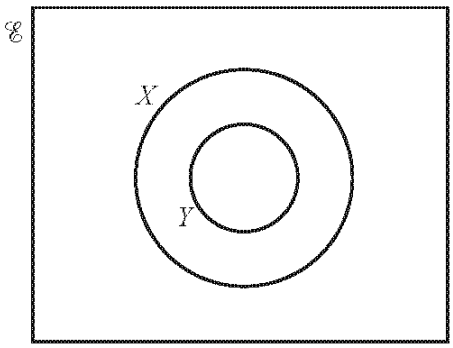
TOPICS	P1	P2
Sets (not included from 2020)	9	8
Intersection Points	17	30
Surds, Indices & Log	46	61
Factor Theorem	20	19
Matrices	7	10
Geometry Coordinate	10	15
Linear Law	19	11
Functions	47	57
Trigonometry	56	41
Circular Measure	26	11
Permutation & Combination	25	19
Binomial Theorem	24	16
Differentiation	62	83
Integration	43	46
Kinematics	19	16
Vectors	20	15
Relative Velocity	7	5
Sequences & Series	14	15

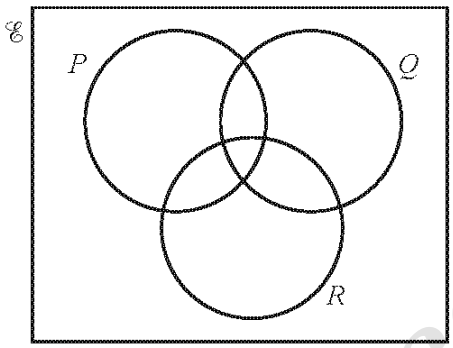
1 – (0606/21_Summer_2017_Q7) – *Sets*

(a) On each of the Venn diagrams below shade the region which represents the given set.

$X \cap Y'$



$P' \cap Q \cap R$



[2]

(b) In a group of students, each student studies at most two of art, music and design. No student studies both music and design.

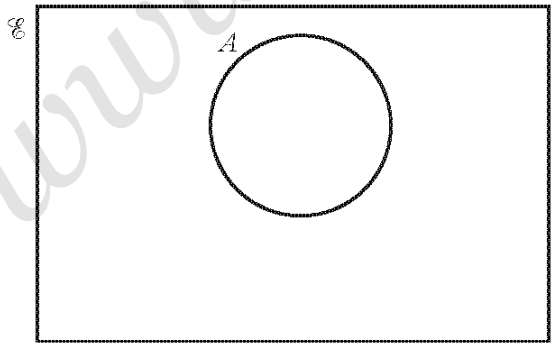
A denotes the set of students who study art,
M denotes the set of students who study music,
D denotes the set of students who study design.

(i) Write the following using set notation.

No student studies both music and design. [1]

There are 100 students in the group. 39 students study art, 45 study music and 36 study design. 12 students study both art and music. 25 students study both art and design.

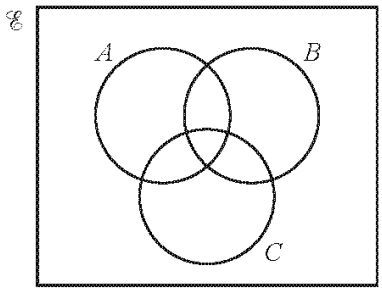
(ii) Complete the Venn diagram below to represent this information and hence find the number of students in the group who do not study any of these subjects.



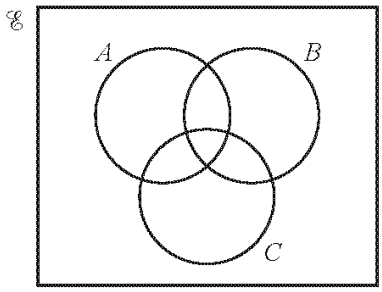
[3]

2 – (0606/23_Winter_2017_Q1) – *Sets*

(a) On each of the diagrams below, shade the region which represents the given set.

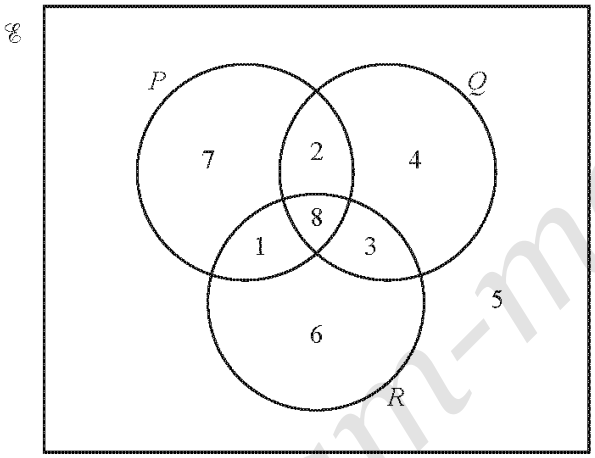


$(A \cup B) \cap C'$



$(A \cap B') \cup C$ [2]

(b)



The Venn diagram shows the number of elements in each of its subsets.

Complete the following.

n(P') = ...

n(($Q \cup R$) $\cap$ P) = ...

n($Q' \cup P$) = ... [3]

3 – (0606/21_Summer_2018_Q1) – *Sets*

A, B and C are subsets of the same universal set.

(i) Write each of the following statements in words.

(a) $A \not\subset B$ [1]

(b) $A \cap C = \varnothing$ [1]

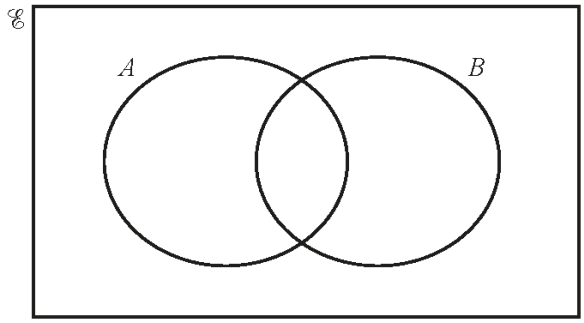
(ii) Write each of the following statements in set notation.

(a) There are 3 elements in set A or B or both. [1]

(b) x is an element of A but it is not an element of C. [1]

4 – (0606/22_Summer_2018_Q2) – *Sets*

(a) On the Venn diagram below, shade the region that represents $A \cap B'$.



[1]

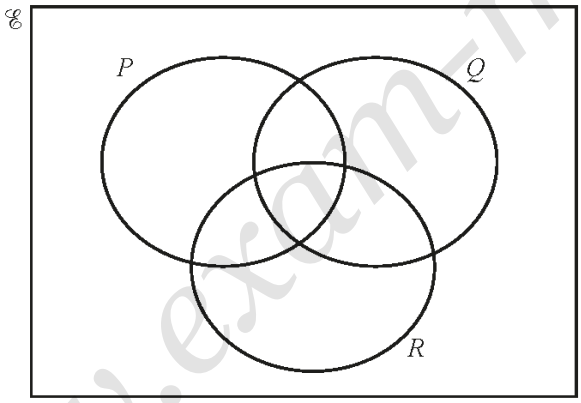
(b) The universal set $\mathscr{E}$ and sets P, Q and R are such that

$(P \cup Q \cup R)' = \varnothing$, $P' \cap (Q \cap R) = \varnothing$,

$\mathrm{n}(Q \cap R) = 8$, $\mathrm{n}(P \cap R) = 8$, $\mathrm{n}(P \cap Q) = 10$,

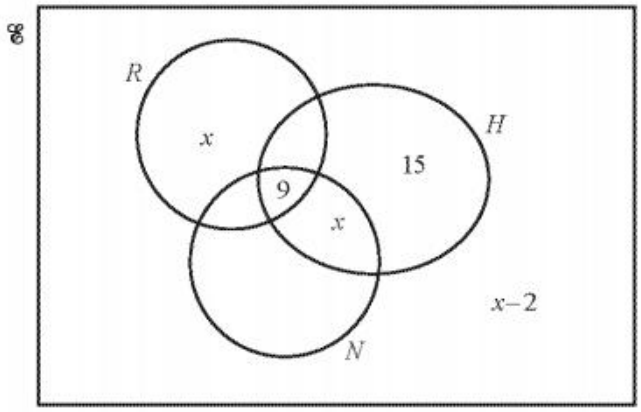
$\mathrm{n}(P) = 21$, $\mathrm{n}(Q) = 15$, $\mathrm{n}(\mathscr{E}) = 30$.

Complete the Venn diagram to show this information and state the value of $\mathrm{n}(R)$.



$\mathrm{n}(R) =$ ..... [4]

5 - (0606/21_Winter_2018_Q11) - *Sets*

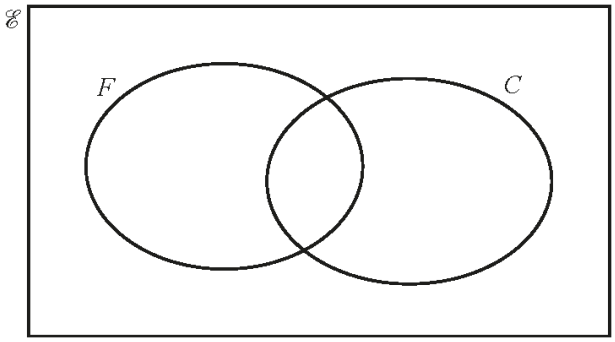


There are 70 girls in a year group at a school. The Venn diagram gives **some** information about the numbers of these girls who play rounders (R), hockey (H) and netball (N).

$n(R) = 28$ $n(H) = 38$ $n(N) = 35$.

Find the value of x and hence the number of girls who play netball only. [6]

6 – (0606/22_Winter_2018_Q2) – *Sets*



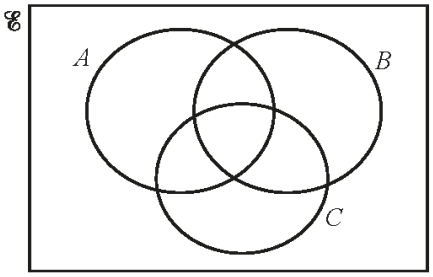
There are 105 boys in a year group at a school. Some boys play football (F) and some play cricket (C).

- x boys play both football and cricket.
- The number of boys that play neither game is the same as the number of boys that play both.
- 40 boys play cricket.
- The number of boys that only play football is twice the number of boys that only play cricket.

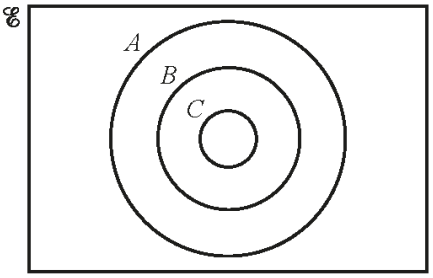
Complete the Venn diagram and find the value of x. [5]

7 – (0606/23_Winter_2018_Q2) – *Sets*

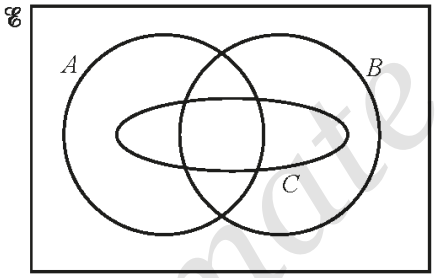
On each of the Venn diagrams below, shade the region indicated.



$(A \cup B \cup C)'$



$A \cap B \cap C'$

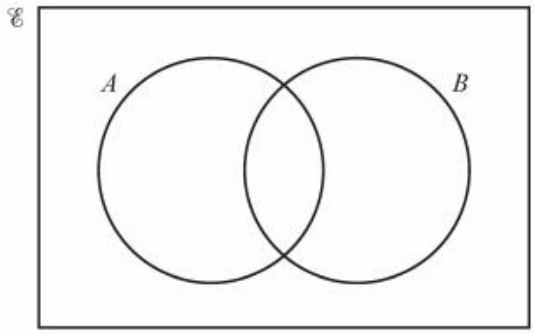


$(A \cap B) \cup C'$

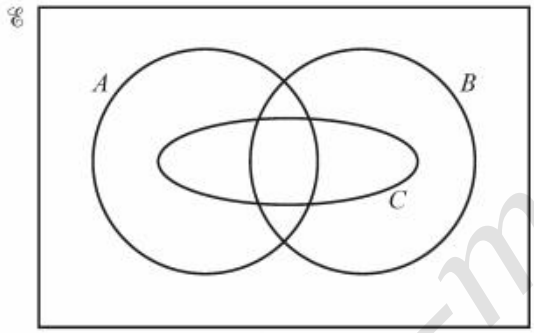
[3]

8 – (0606/22_Winter_2019_Q1) – *Sets*

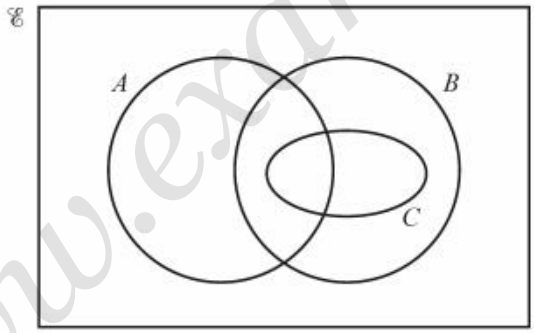
On each of the Venn diagrams below, shade the region indicated.



$(A' \cap B) \cup (A \cap B')$



$(A \cap B) \cup C$



$A \cap B \cap C'$

[3]

1 - (0606/21_Summer_2017_Q9) - *Intersection Points, Coordinate Geometry*

The curve $3x^2 + xy - y^2 + 4y - 3 = 0$ and the line $y = 2(1 - x)$ intersect at the points A and B.

(i) Find the coordinates of A and of B. [5]

(ii) Find the equation of the perpendicular bisector of the line AB, giving your answer in the form $ax + by = c$, where a, b and c are integers. [4]

2 – (0606/21_Winter_2017_Q4) – *Intersection Points*

Solve the following simultaneous equations for x and y, giving each answer in its simplest surd form.

$$\sqrt{3}x + y = 4$$

$$x - 2y = 5\sqrt{3}$$ [5]

3 - (0606/22_Summer_2018_Q4) - *Intersection Points*

Find the coordinates of the points where the line $2y - 3x = 6$ intersects the curve $\frac{x^2}{4} + \frac{y^2}{9} = 5$. [5]

5 - (0606/22_Winter_2018_Q10) - *Intersection Points*

Two lines are tangents to the curve $y = 12 - 4x - x^2$. The equation of each tangent is of the form $y = 2k + 1 - kx$, where k is a constant.

(i) Find the two possible values of k. [5]

(ii) Find the coordinates of the point of intersection of the two tangents. [4]

6 – (0606/23_Winter_2018_Q11) – *Intersection Points*

A line with equation $y = -5x + k + 5$ is a tangent to a curve with equation $y = 7 - kx - x^2$.

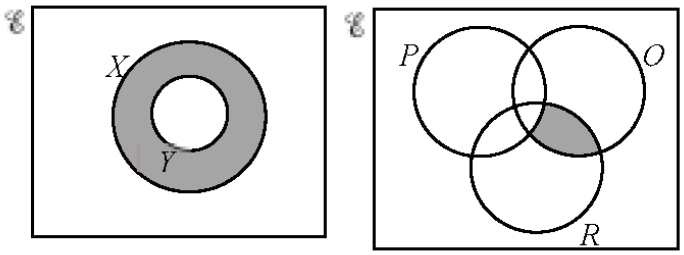
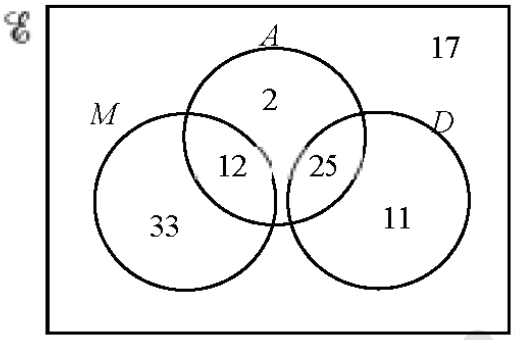
(i) Find the two possible values of k. [5]

(ii) Find, for **each** of your values of k,

- the equation of the tangent
- the equation of the curve
- the coordinates of the point of contact of the tangent and the curve. [5]

ANSWERS

1 - (0606/21_Summer_2017_Q7) - *Sets*

(a)	
(b)(i)	$\mathrm{n}(M \cap D) = 0$ or $M \cap D = \varnothing$
(b)(ii)	

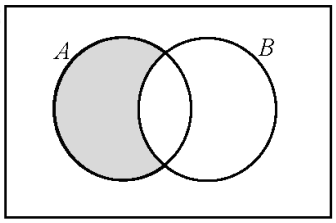
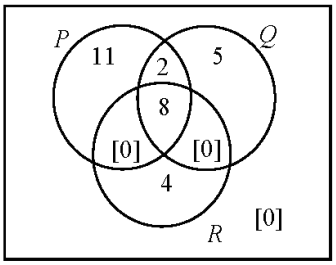
2 - (0606/23_Winter_2017_Q1) - *Sets*

(a)		B2
(b)	$\mathrm{n}(P')$ = 18	B1
	$\mathrm{n}((Q \cup R) \cap P)$ = 11	B1
	$\mathrm{n}(Q' \cup P)$ = 29	B1

3 – (0606/21_Summer_2018_Q1) – *Sets*

(i)(a)	A is not a [proper] subset of B oe	**B1**	
(i)(b)	A and C are mutually exclusive oe or A intersection C is the empty set oe	**B1**	
(ii)(a)	$\mathrm{n}(A \cup B) = 3$	**B1**	
(ii)(b)	$x \in (A \cap C')$ oe	**B1**	

4 – (0606/22_Summer_2018_Q2) – *Sets*

(a)		**B1**	
(b)		**B3**	**B1** for 8 correctly placed and all the empty regions correct **B1** for 11, 2, 5 correctly placed **B1** for 4 correctly placed **maximum of 2 marks if fully correct but other values such as 30, 21 and/or 15 present within the diagram**
	their 12	**B1**	**STRICT FT** *their* Venn diagram

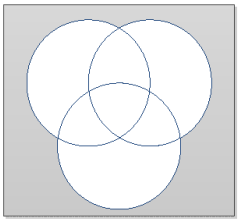
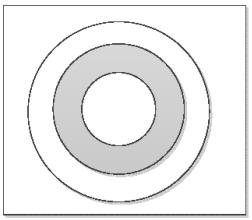
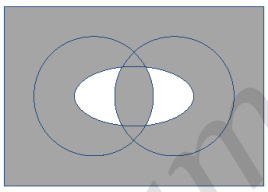
5 – (0606/21_Winter_2018_Q11) – *Sets*

	$\mathrm{n}((R \cap H) \cap N') = 14 - x$	**B1**	
	$\mathrm{n}((R \cap N) \cap H') = 5$	**B1**	
	$\mathrm{n}(N \cap (\mathrm{R} \cup H)') = 21 - x$	**B1**	
	$x + 9 + x + 15 + 14 - x + 5 + 21 - x + x - 2 = 70$	**M1**	correctly form equation in x and attempt to solve
	$x = 8$	**A1**	
	$\mathrm{n}(N \cap (\mathrm{R} \cup H)') = 13$	**A1**	

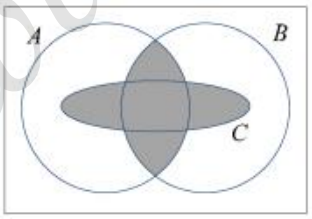
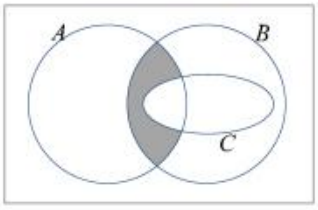
6 - (0606/22_Winter_2018_Q2) - *Sets*

	$n(F \cap C) = n(F \cup C)' = x$	**B1**	
	$n(C \cap F') = 40 - x$	**B1**	
	$n(F \cap C') = 80 - 2x$ or $2(40 - x)$	**B1**	
	$x + x + 40 - x + 80 - 2x = 105$	**M1**	
	$x = 15$	**A1**	cao

7 - (0606/23_Winter_2018_Q2) - *Sets*

	  	**3**	**B1** for each correct diagram

8 - (0606/22_Winter_2019_Q1) - *Sets*

		**B1**	
		**B1**	
		**B 1**	

1 - (0606/21_Summer_2017_Q9) - *Intersection Points, Coordinate Geometry*

(i)	Substitution of $y = 2(1-x)$
	$-3x^2 + 2x + 1 = 0$ oe $\left(3x^2 - 2x - 1 = 0\right)$
	Solving *their* quadratic found from eliminating one variable $(3x+1)(1-x)$ or $(3x+1)(x-1)$
	$\left(-\frac{1}{3}, \frac{8}{3}\right)$ oe and $(1, 0)$ oe isw nfww

(ii)	$[m =]\frac{1}{2}$ cao
	$\left(\frac{1}{3}, \frac{4}{3}\right)$
	$y - their\frac{4}{3} = their\frac{1}{2}\left(x - their\frac{1}{3}\right)$
	$6y - 3x = 7$

2 – (0606/21_Winter_2017_Q4) – *Intersection Points*

$x-2\left(4-\sqrt{3}x\right)=5\sqrt{3}$	**M1**
$x=\dfrac{5\sqrt{3}+8}{2\sqrt{3}+1}$	**A1**
$x=\dfrac{\left(5\sqrt{3}+8\right)\left(2\sqrt{3}-1\right)}{\left(2\sqrt{3}+1\right)\left(2\sqrt{3}-1\right)}$	**M1**
$x=2+\sqrt{3}$	**A1**
$y=1-2\sqrt{3}$	**A1**
<u>Alternative method</u> $\sqrt{3}\left(5\sqrt{3}+2y\right)+y=4$	**M1**
$y=\dfrac{-11}{\left(2\sqrt{3}+1\right)}$	**A1**
$y=\dfrac{-11\left(2\sqrt{3}-1\right)}{\left(2\sqrt{3}+1\right)\left(2\sqrt{3}-1\right)}$	**M1**
$y=1-2\sqrt{3}$	**A1**
$x=2+\sqrt{3}$	**A1**

3 – (0606/22_Summer_2018_Q4) – *Intersection Points*

	Eliminates one of the unknowns	**M1**	
	Simplifies to a correct 3-term quadratic: $2x^2 + 4x - 16$ [= 0] oe or $2y^2 - 6y - 36$ [= 0] oe	**A1**	
	Factorises or solves $(x+4)(x-2)=0$ oe or $(y+3)(y-6)=0$ oe	**M1**	**FT** *their* 3-term quadratic in x or y;
	(2, 6) and (–4, –3) oe	**A2**	Not from wrong working **A1** for either (2, 6) or (–4, –3) or **A1** for $x = 2$ and $x = -4$ or $y = 6$ and $y = -3$

4 – (0606/21_Winter_2018_Q10) – *Intersection Points*

(i)	$12-2x=k+6+kx-x^2$ $\rightarrow x^2-(2+k)x+6-k=0$	**M1**	* Equate and collect terms
	$b^2-4ac=0$ $\rightarrow (2+k)^2=4(6-k)$	**M1**	**Dep***
	$k^2+8k-20=0$	**A1**	
	$(k+10)(k-2)=0$	**M1**	
	$k=-10$ or 2	**A1**	
(ii)	$(-4,\ 20)$ and $(2,\ 8)$	**3**	**M1** Insert values of k in equations and solve for x **A1** $x^2+8x+16=0 \rightarrow x=-4$ $\rightarrow y=20$ **A1** $x^2-4x+4=0$ $\rightarrow x=2 \rightarrow y=8$

(iii)	Grad of perpendicular $=\frac{1}{2}$	**B1**	
	Midpoint $(-1\ ,14)$	**B1**	**FT**
	Eqn $\frac{y-14}{x+1}=\frac{1}{2} \rightarrow y=\frac{1}{2}x+14.5$	**B1**	**FT**