SYDNEY BOYS HIGH
MOORE PARK, SURRY HILLS

2011
YEAR 7 HALF-YEARLY EXAMINATION

Mathematics

Directions to Candidates:

- Answer all questions in the spaces provided in this question booklet.

- If additional working space is needed, use the spare pages at the end of the booklet. Show clearly which question you are continuing.

- Full marks may not be awarded for careless or badly arranged work.

- Answers should be given in simplest exact form unless otherwise stated.

- Use black or blue pen for written answers, but pencil for diagrams and graphs.

- Calculators may **NOT** be used.

Time allowed: 60 minutes
Examiner: Mr D. Hespe

Your name: _____

Your Mathematics Class (Tick the box)	
7E Mr Elliot	
7F Ms Kilmore	
7M Ms Nesbitt	
7R Ms Ward	
7S Mr Boros	
7T Mr Combert	

Markers' Use Only	
Question 1	/15
Question 2	/15
Question 3	/15
Question 4	/15
Question 5	/15
Question 6	/15
Total	/90

Marks

Question 1 (15 marks)

(a) A set of playing cards is called a .... of cards. [1]

....

(b) Give an example of:
   (i) a well-defined set: [1]

....

   (ii) a set that is NOT well-defined: [1]

....

(c) Calculate:
   (i) $\begin{array}{r} 3\,607 \\ +\ \ 986 \\ \hline \end{array}$ [1]

....

   (ii) -7^2 [1]

....

   (iii) $\begin{array}{r} 5\,416 \\ -\ 3\,798 \\ \hline \end{array}$ [1]

....

(d) Write this Egyptian number in Hindu-Arabic form. [1]

....

(e) Write this year, 2011, as:
  (i) Roman numerals, ⊡1

  ....

  (ii) Egyptian numerals. ⊡1

  ....

(f) Simplify:
  (i) $2x + 3x$ ⊡1

  ....

  (ii) $a^2 - 3a^2 + 4a^2$ ⊡1

  ....

  (iii) $3u + 5v - 6(v - u)$ ⊡2

  ....
  ....

  (iv) $2t \times 3t \times 4b$ ⊡2

  ....

Question 2 (15 marks)

  (a) List the elements in { Letters of the word *integration*} : ⊡2

  ....

  (b) Rewrite the following in words:
    (i) $3 \in \{0, 1, 2, 3, 4\}$ ⊡2

  ....
  ....

  (ii) $p \notin \{\text{vowels}\}$. ⊡2

  ....
  ....

  (c) Write T(true) or F(false) for these sentences:
    (i) $(3 + 4) \times 2 = (3 \times 2) + (4 \times 2)$ ⊡1

  ....

    (ii) $(2 + 7) + 3 \neq 2 + (7 + 3)$ ⊡1

  ....

    (iii) $(9 \times 18) \div 6 = 9 \times (18 \div 6)$ ⊡1

  ....

(d) What is the value of the 5 in the number 453 289? ☐1

....

(e) (i) Write the base ten number $80\,467.2_{\text{ten}}$ in expanded form. ☐2

....

....

(ii) Write 101.11_{two} in expanded form and find its decimal equivalent. ☐3

....

....

Question 3 (15 marks)

(a) $n\big(\{\text{vowels}\}\big)$ ☐1

....

(b) Evaluate $2\frac{1}{3} - 4\frac{2}{5}$ ☐2

....

....

....

(c) Which of the following are empty sets, finite sets, or infinite sets:

(i) {boys in the Hall} ☐1

....

(ii) {∅} ☐1

....

(iii) ∅ ☐1

....

(iv) {all points on a line} ☐1

....

(d) The sum of two numbers is 350 and one of them is 208. [2]
What is their difference?

....

....

(e) Label the axes appropriately and plot the [3]
points $A(3, 2)$ and $B(-2, 1)$.
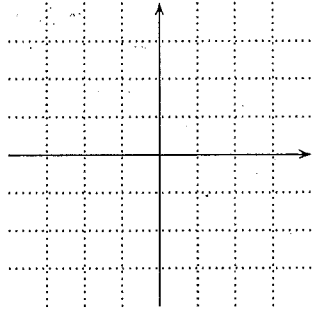
(f) Write in mathematical notation: [3]

The set of odd numbers between one hundred and two hundred.

....

Question 4 (15 marks)

(a) Graph $\{2, 3, 4, 6\}$ on a number line. [2]

....

(b) List *all* the subsets of $\{a, b, c\}$. [3]

....

....

(c) Change the decimal number 237 to its binary equivalent. [2]

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(d) If $A = \{14, 13, 12, 10, 8\}$ and $B = \{8, 9, 10, 11, 12\}$, what is:
(i) $A \cup B$? [1]

....

(ii) $A \cap B$? [1]

....

(iii) $A \cup \varnothing$? [1]

....

(iv) $B \cap \varnothing$? [1]

....

(e) What are disjoint sets? (Give an example to illustrate your answer.) ☐2

....

....

....

(f) Give the rule (in words or in pronumerals) for this table of values: ☐2

p	1	2	3	4	6
q	1	3	6	10	21

....

....

....

Question 5 (15 marks)

(a) Insert grouping symbols so that each sentence becomes *true*.

(i) $4 \times 5 + 6 \times 5 = 220$ ☐1

....

(ii) $4 \times 5 + 6 \times 5 = 140$ ☐1

....

(b) Complete the following tables of values for the rules given.

(i) $y = 2x + 3$ ☐2

x	1	2	3	4
y				

(ii) $s = 100 - t^2$ ☐2

t	1	5	7	11
s				

(c) Janet uses the table to produce the straight line below. ☐3
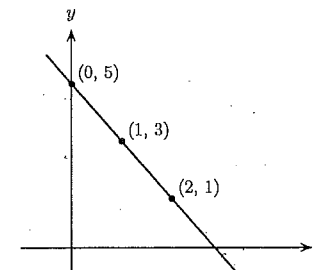
x	0	1	2
y	5	3	1

Which of the following also lie on this line? (Circle all the correct answers.)

A. $(-1, 3)$ B. $(4, -3)$ C. $(-2, 9)$ D. $(3, 1)$

(d) (i) Write down the next two rows of this pattern: [2]
$$2 = \quad 2 = 1 \times 2$$
$$2 + 4 = \quad 6 = 2 \times 3$$
$$2 + 4 + 6 = 12 = 3 \times 4$$

....

....

(ii) Hence or otherwise, calculate the value of $2 + 4 + 6 + 8 + \cdots + 1000$. [2]

....

....

(e) The formula for converting the Fahrenheit temperature (still used in the USA) [2]
to the international standard Celsius temperature (used in Australia) is

$$C = \frac{5}{9}(F - 32).$$

To the nearest degree Celsius, what is 80° F?

....

....

....

Question 6 (15 marks)

(a) A pair of six-sided dice were rolled 200 times. The sum of the numbers was [5]
greater than 6 in 132 rolls and less than 8 in 145 rolls.
How many times was this sum
  (i) 7;

....

....

....

  (ii) greater than 7;

....

  (iii) less than 7?

....

(b) One-third of a flagpole is painted sky blue, one-quarter is chocolate brown,
and the upper 3.5 metres is left as unpainted aluminium.
  (i) What fraction is not painted? [3]

....

....

....

....

  (ii) How long is the flagpole? [2]

....

....

....

(c) A boy found an old account book that used to belong to his grandfather in the attic and was puzzled by the additions in it until his mother explained the old money system:

One pound (symbol £.) was made up of twenty shillings (symbol s.), and one shilling was made up of twelve pennies (symbol d.).

Because of water damage, one of the lines in the following account is missing. Find the missing balance.

£.	s.	d.
49	3	4
46	7	8
2	7	1
2	19	3
2	12	10
1	15	0
1	10	0

◄ Missing line

155	12	9

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End of Paper

Extra working page

SYDNEY BOYS HIGH
MOORE PARK, SURRY HILLS

2011
YEAR 7 HALF-YEARLY EXAMINATION

Mathematics Solutions

Question 1 (15 marks)

(a) A set of playing cards is called a .... of cards.   [1]

> Solution: Deck, pack, or hand.

(b) Give an example of:

  (i) a well-defined set: [1]

> Solution: *e.g.* $\{1, 2, 3\}$

  (ii) a set that is NOT well-defined: [1]

> Solution: *e.g.* {good things}

(c) Calculate:

  (i) $\begin{array}{r} 3\,607 \\ +\quad 986 \\ \hline \end{array}$ [1]

> Solution: $4\,593$
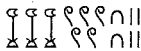
  (ii) -7^2 [1]

> Solution: -49

  (iii) $\begin{array}{r} 5\,416 \\ -\quad 3\,798 \\ \hline \end{array}$ [1]

> Solution: $1\,618$

(d) ᛘᛘᛘ ᚱᚱᚱ ∩|| Write this Egyptian number in Hindu-Arabic form. $\boxed{1}$

Solution: 3524.

(e) Write this year, 2011, as:
  (i) Roman numerals, $\boxed{1}$

Solution: MMXI

  (ii) Egyptian numerals. $\boxed{1}$

Solution: ᛚᛚ∩|

(f) Simplify:
  (i) $2x + 3x$ $\boxed{1}$

Solution: $5x$

  (ii) $a^2 - 3a^2 + 4a^2$ $\boxed{1}$

Solution: $2a^2$

  (iii) $3u + 5v - 6(v - u)$ $\boxed{2}$

Solution: $3u + 5v - 6v + 6u = 9u - v$

  (iv) $2t \times 3t \times 4b$ $\boxed{2}$

Solution: $24t^2b$

Question 2 (15 marks)
  (a) List the elements in { Letters of the word *integration* } : $\boxed{2}$

Solution: i, n, t, e, g, r, a, o.

  (b) Rewrite the following in words:
    (i) $3 \in \{0, 1, 2, 3, 4\}$ $\boxed{2}$

Solution: Three is an element of the set of integers from zero to four.

    (ii) $p \notin \{\text{vowels}\}$. $\boxed{2}$

Solution: p is not an element of the set of vowels.

  (c) Write T(true) or F(false) for these sentences:
    (i) $(3 + 4) \times 2 = (3 \times 2) + (4 \times 2)$ $\boxed{1}$

Solution: T

    (ii) $(2 + 7) + 3 \neq 2 + (7 + 3)$ $\boxed{1}$

Solution: F

    (iii) $(9 \times 18) \div 6 = 9 \times (18 \div 6)$ $\boxed{1}$

Solution: T

(d) What is the value of the 5 in the number 453 289? $\boxed{1}$

Solution: 50 000.

(e) (i) Write the base ten number $80\,467.2_{\text{ten}}$ in expanded form. $\boxed{2}$

Solution: $8 \times 10^4 + 4 \times 10 + 6 \times 10 + 7 + 2 \times 10^{-1}$

(ii) Write 101.11_{two} in expanded form and find its decimal equivalent. $\boxed{3}$

Solution: $1 \times 2^2 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2}$
or $1 \times 10^{10} + 1 \times 10^0 + 1 \times 10^{-1} + 1 \times 10^{-10}$.
Its decimal equivalent is $4 + 1 + \frac{1}{2} + \frac{1}{4} = 5\frac{3}{4}$.

Question 3 (15 marks)

(a) $n(\{\text{vowels}\})$ $\boxed{1}$

Solution: 5

(b) Evaluate $2\frac{1}{3} - 4\frac{2}{5}$ $\boxed{2}$

Solution: $\frac{7}{3} - \frac{22}{5} = \frac{5 \times 7 - 3 \times 22}{3 \times 5},$
$= \frac{35 - 66}{15},$
$= \frac{-31}{15},$
$= -2\frac{1}{15}.$

(c) Which of the following are empty sets, finite sets, or infinite sets:

(i) {boys in the Hall} $\boxed{1}$

Solution: Finite set.

(ii) $\{\varnothing\}$ $\boxed{1}$

Solution: Finite set.

(iii) $\varnothing$ $\boxed{1}$

Solution: Empty set.
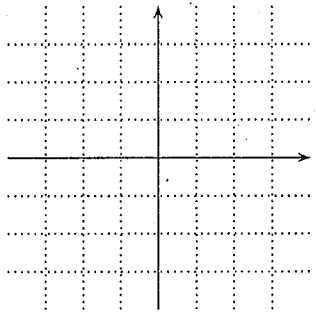
(iv) {all points on a line} $\boxed{1}$

Solution: Infinite set.

(d) The sum of two numbers is 350 and one of them is 208.   ☐2
What is their difference?

Solution: $350 - 208 = 142$ (which is the other number),
$208 - 142 = 66$ (which is their difference).
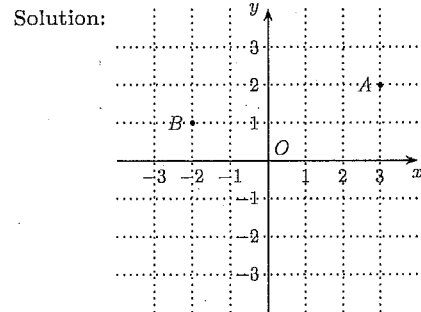
(e)   Label the axes appropriately and plot the   ☐3
points $A(3, 2)$ and $B(-2, 1)$.
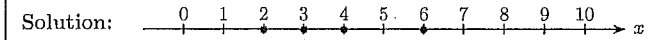
Solution:

(f) Write in mathematical notation: ☐3

The set of odd numbers between one hundred and two hundred.

Solution: $\{101, 103, 105, \ldots 197, 199\}$

Question 4 (15 marks)

(a) Graph $\{2, 3, 4, 6\}$ on a number line.   ☐2

Solution:

(b) List *all* the subsets of $\{a, b, c\}$.   ☐3

Solution: $\{a, b, c\}$, $\{a, b\}$, $\{a, c\}$, $\{b, c\}$, $\{a\}$, $\{b\}$, $\{c\}$, $\varnothing$

(c) Change the decimal number 237 to its binary equivalent.   ☐2

Solution:

2	237	
2	118	1
2	59	0
2	29	1
2	14	1
2	7	0
2	3	1
2	1	1
	0	1

So the binary equivalent is 11 101 101.

(d) If $A = \{14, 13, 12, 10, 8\}$ and $B = \{8, 9, 10, 11, 12\}$, what is:

(i) $A \cup B$?   ☐1

Solution: $\{8, 9, 10, 11, 12, 13, 14\}$

(ii) $A \cap B$?   ☐1

Solution: $\{8, 10, 12\}$

(iii) $A \cup \varnothing$?   ☐1

Solution: A

(iv) $B \cap \varnothing$?   ☐1

Solution: $\varnothing$.

(e) What are disjoint sets? (Give an example to illustrate your answer.) $\boxed{2}$

> Solution: They are sets with no common elements,
> e.g., {even numbers} and {odd numbers}.

(f) Give the rule (in words or in pronumerals) for this table of values: $\boxed{2}$

p	1	2	3	4	6
q	1	3	6	10	21

> Solution: Add the new value of p to the previous value of q,
> or $q = \dfrac{p(p+1)}{2}$.

Question 5 (15 marks)

(a) Insert grouping symbols so that each sentence becomes *true*.

(i) $4 \times 5 + 6 \times 5 = 220$ $\boxed{1}$

> Solution: $4 \times (5 + 6) \times 5 = 220$

(ii) $4 \times 5 + 6 \times 5 = 140$ $\boxed{1}$

> Solution: $4 \times (5 + 6 \times 5) = 140$

(b) Complete the following tables of values for the rules given.

(i) $y = 2x + 3$ $\boxed{2}$

x	1	2	3	4
y				

> Solution:
>
> | x | 1 | 2 | 3 | 4 |
> |---|---|---|---|---|
> | y | 5 | 7 | 9 | 11 |

(ii) $s = 100 - t^2$ $\boxed{2}$

t	1	5	7	11
s				

> Solution:
>
> | t | 1 | 5 | 7 | 11 |
> |---|---|---|---|---|
> | s | 99 | 75 | 51 | -21 |

(c) Janet uses the table to produce the straight line below. $\boxed{3}$

x	0	1	2
y	5	3	1
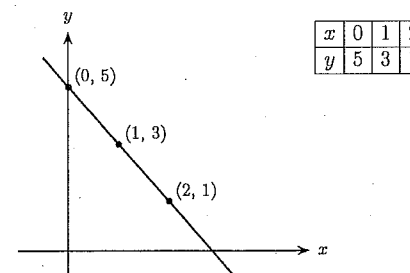
Which of the following also lie on this line? (Circle all the correct answers.)

A. $(-1, 3)$ B. $(4, -3)$ C. $(-2, 9)$ D. $(3, 1)$

> Solution: B, C.

(d) (i) Write down the next two rows of this pattern:

$$2 = \quad 2 = 1 \times 2$$
$$2 + 4 = \quad 6 = 2 \times 3$$
$$2 + 4 + 6 = 12 = 3 \times 4$$

Solution: $\quad 2 + 4 + 6 + 8 = 20 = 4 \times 5$
$\qquad 2 + 4 + 6 + 8 + 10 = 30 = 5 \times 6$

[2]

(ii) Hence or otherwise, calculate the value of $2 + 4 + 6 + 8 + \cdots + 1000$.

[2]

Solution: $\quad 2 + 4 + 6 + 8 + \cdots + 1000 = 500 \times 501$,
$\qquad\qquad\qquad\qquad\qquad\qquad = 250\,500.$

(e) The formula for converting the Fahrenheit temperature (still used in the USA) to the international standard Celsius temperature (used in Australia) is

[2]

$$C = \frac{5}{9}(F - 32).$$

To the nearest degree Celsius, what is $80°\,F$?

Solution: $\quad C = \dfrac{5(80 - 32)}{9}$,

$\qquad\quad = \dfrac{5 \times 48}{9}$,

$\qquad\quad = \dfrac{240}{9}$,

$\qquad\quad \approx 26.6.$

$$\begin{array}{r|l} & 26.6 \\ \hline 9 & 240 \\ & 18 \\ \hline & 60 \\ & 54 \\ \hline & 6.0 \\ & 5.4 \end{array}$$
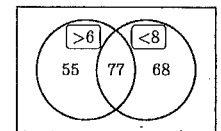
So $80°\,F$ is almost $27°\,C$.

Question 6 (15 marks)

(a) A pair of six-sided dice were rolled 200 times. The sum of the numbers was greater than 6 in 132 rolls and less than 8 in 145 rolls.
How many times was this sum

[5]

(i) 7;

Solution: $\quad 132 + 145 = 277,$
$\qquad\qquad 277 - 200 = 77,$
$\qquad\qquad 132 - 77 = 55,$
$\qquad\qquad 145 - 77 = 68.$

So it is equal to 7 for 77 rolls.

(ii) greater than 7;

Solution: 55 rolls.

(iii) less than 7?

Solution: 68 rolls.

(b) One-third of a flagpole is painted sky blue, one-quarter is chocolate brown, and the upper 3.5 metres is left as unpainted aluminium.

(i) What fraction is not painted?

[3]

Solution: Amount painted $= \frac{1}{3} + \frac{1}{4}$,

$\qquad\qquad\qquad\quad = \frac{4+3}{12}$,

$\qquad\qquad\qquad\quad = \frac{7}{12}.$

$\therefore$ Fraction not painted $= \frac{5}{12}.$

(ii) How long is the flagpole?

[2]

Solution: $\quad \frac{5}{12} \implies 3.5\,\mathrm{m}$,

$\qquad\qquad \frac{1}{12} \implies 0.7\,\mathrm{m}$,

$\qquad\qquad \frac{12}{12} \implies 8.4\,\mathrm{m}.$

So the total length is $8.4\,\mathrm{m}.$

(c) A boy found an old account book that used to belong to his grandfather in the attic and was puzzled by the additions in it until his mother explained the old money system: [5]

> One pound (symbol £.) was made up of twenty shillings (symbol s.), and one shilling was made up of twelve pennies (symbol d.).

Because of water damage, one of the lines in the following account is missing. Find the missing balance.

£.	s.	d.	
49	3	4	
46	7	8	
2	7	1	
2	19	3	
2	12	10	
1	15	0	
1	10	0	
			◀ Missing line
155	12	9	

Solution: Total is £106. 15s. 2d. without the missing balance.

	£.	s,	d.
	155	12	9
−	106	15	2
	48	17	7

So the missing balance is £48. 17s. 7d.