100 Years
NORTH SYDNEY BOYS HIGH SCHOOL
1912 - 2012

STAGE 5.1-5.3 MATHEMATICS

Year 9 Final Examination

Tuesday November 12, 2013

General instructions

- Working time – $1\frac{1}{2}$ hours.
- Write your answers on the paper supplied.
- Marks may be deducted for careless or poorly arranged work.
- Write using blue or black pen. Where diagrams are to be sketched, these may be done in pencil.
- Board approved calculators may be used.
- All necessary working should be shown in every question.
- Attempt **all** questions.
- At the conclusion of the examination, bundle the sheets used in the correct order within this paper and hand to examination supervisors.

Class (please ✔)

- ◯ 9MAT.A – Ms Ziaziaris
- ◯ 9MAT.B – Mr Weiss
- ◯ 9MAT.C – Mr Ireland
- ◯ 9MAT.D – Mr Zuber
- ◯ 9MAT.E – Mr Lowe

NAME: ..... **# SHEETS USED**: .....

Marker's use only.

QUESTION	1	2	3	4	5	6	7	8	9	**Total**	%
MARKS	/15	/10	/15	/15	/9	/10	/12	/15	/13	/114	

Question 1 (15 Marks) Commence a NEW page. **Marks**

(a) Write the basic numeral for 1.397×10^5. **1**

(b) Write 173.69 correct to 2 significant figures. **1**

(c) Write $\sin 25^\circ$ correct to 3 decimal places. **1**

(d) Fully simplify $\sqrt{49x^{16}}$. **1**

(e) Write $3x^{-2}$ without a negative index. **1**

(f) Find the value of a if $7\sqrt{3} = \sqrt{a}$. **1**

(g) Increase \$750 by $12\frac{1}{4}\%$. **1**

(h) Convert 98 m/s to kilometres per hour. **1**

(i) How many 375 mL containers does it take to fill a 30 L bucket? **1**

(j) Fully simplify:

i. $5\sqrt{28}$ **2**

ii. $\left(5\sqrt{6} - 4\right)^2$ **2**

(k) Express $\dfrac{5}{4 - \sqrt{3}}$ with a rational denominator, in simplest form. **2**

Question 2 (10 Marks) Commence a NEW page. **Marks**

(a) Given $A(2,4)$, $B(-5,6)$, $C(3,1)$ and $D(-7,1)$

i. Find the gradient of CD. **1**

ii. Find the midpoint of AD. **2**

iii. Find the length of AB. **2**

(b) What is the equation of the line that passes through $(3,5)$ and is parallel to the x axis? (Hint: draw a diagram). **1**

(c) Write the gradient and y intercept of $2x+3y=6$. **2**

(d) What is the equation of the line with gradient $\frac{2}{3}$ that passes through the point $(0,-3)$? **2**

Question 3 (15 Marks) Commence a NEW page. **Marks**

(a) Expand and simplify $(3m+5)(2m-3)$. **1**

(b) Fully simplify $\dfrac{18ab^2c}{6abc^3}$. **1**

(c) Fully factorise $6x^2-5x-4$. **2**

(d) Fully simplfy:

i. $3^y \times 3^{1-2y}$. **1**

ii. $(5n^2)^3$. **1**

iii. $\dfrac{ab-abc}{2ac-2ac^2}$. **2**

iv. $\dfrac{x-3}{5}-\dfrac{x-4}{6}$. **2**

(e) If $p=3x$ and $S=2x^2$, find the value of S when $p=-12$. **2**

(f) Solve and sketch the solution on the number line: **3**

$$3x+5>6x-4$$

Question 4 (15 Marks) Commence a NEW page. **Marks**

(a) Make p the subject of $y = \dfrac{2x - p}{6}$. **2**

(b) Solve the following equations:

i. $\dfrac{3x + 2}{2} = \dfrac{x}{5} - 4$. **2**

ii. $\dfrac{4}{x} - \dfrac{3}{2x} = 9$. **3**

iii. $5x^2 = 100x$. **3**

(c) Find the value of r if $S = \dfrac{a}{1 - r}$, $S = 32$ and $a = 8$. **2**

(d) Solve the following equations simultaneously: **3**

$$\begin{cases} x + 2y = 5 \\ 3x - 2y = 7 \end{cases}$$

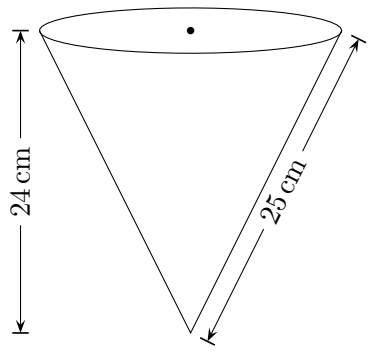
Question 5 (9 Marks) Commence a NEW page. **Marks**

(a) Calculate the area of a rhombus with diagonals of length 7 cm and 10 cm. **1**

(b) Find the length of each side of a cube if its volume is $15\,625\,\text{cm}^3$. **1**

(c) The radius of the earth is approximately 6 400 km. What is the circumference of the earth at the equator? **1**

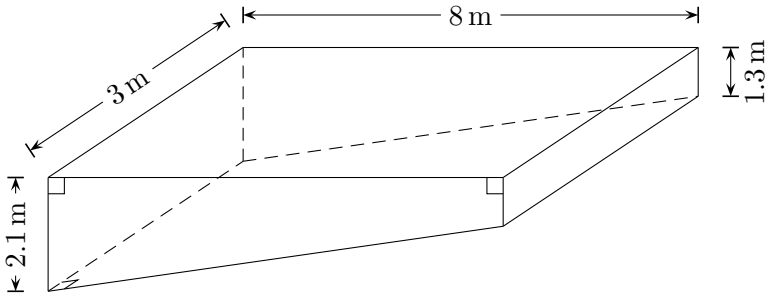
(d) Find the total surface area of this cone (with a closed top): **3**



Question 5 continued on the next page...

Question 5 continued from page 4

(e) A swimming pool is 8 m long and 3 m wide. Its depth is 2.1 m at the deeper end, and 1.3 m at the shallow end, with a constant drop in the depth.



Find:

i. the volume (in cubic metres) of the pool. **2**

ii. the capacity (in litres). **1**

Question 6 (10 Marks) Commence a NEW page. **Marks**

(a) Fill in the missing word/expression to make the statement true.
(Write these words on the supplied paper.)

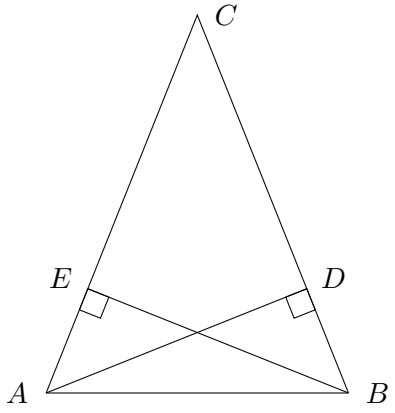
i. The sum of interior angles of an n sided polygon is ..... degrees. **1**

ii. Each angle of an ..... triangle is $60°$. **1**

iii. Two triangles are ..... if all of their corresponding sides are equal. **1**

iv. Opposite sides of a parallelogram are ..... and **2**

(b) AD and BE are two altitudes of $\triangle ABC$. If $AD = BE$,



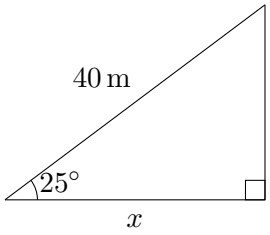
i. Prove that $\triangle ABE \equiv \triangle BAD$. **4**

ii. Hence prove that $\triangle ABC$ is isosceles. **1**

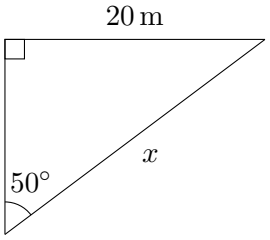
Question 7 (12 Marks) Commence a NEW page. **Marks**

(a) Find the value of the following pronumerals.

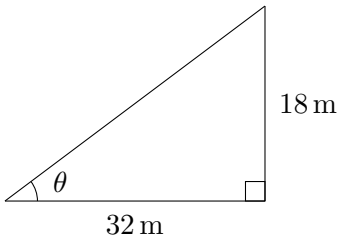
i. Correct to 1 decimal place. **2**



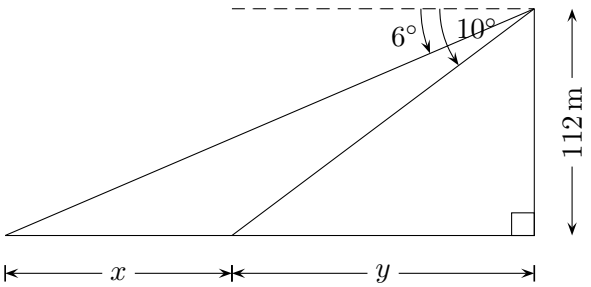
ii. Correct to 1 decimal place. **2**



iii. Correct to the nearest degree. **2**



(b) Find the length of x and y to two decimal places. **3**



(c) A ship sails from port A on a bearing of 124°T towards port B, which is 80 km east of port A.

i. Sketch the diagram that represents the information. **1**

ii. How far has the ship sailed, correct to the nearest kilometre? **2**

Question 8 (15 Marks) Commence a NEW page. **Marks**

(a) At a school swimming carnival, 40 students entered the diving competition. Each dive was awarded points on a scale of 1 to 10. The table below shows the distribution of the scores.

Diving competition scores

Score	1	2	3	4	5	6	7	8	9	10
Students	1	1	2	3	4	4	5	9	8	3

i. Find the mode score. **1**

ii. Find the median score. **1**

iii. Find the mean score, correct to 2 decimal places. **1**

iv. Find the upper and lower quartile. **2**

v. Draw a box and whisker plot to represent the distribution of scores. **2**

(b) Max has completed four of the five tasks for the year in English and is presently averaging 73%. **2**

Max wishes to improve and would like his average by the end of the year, to be 80%. Is this possible? Clearly explain your answer.

(c) The following table shows the income tax rates for individuals who are residents of Australia for tax purposes for the whole financial year and who do not leave full-time education for the first time during the financial year.

Taxable income	**Tax on this income**
\$0 – \$18 200	Nil
\$28 100 – \$37 000	19c for each \$1 over \$18 200
\$37 001 – \$80 000	\$3 572 plus 32.5c for each \$1 over \$37 000
\$80 001 – \$180 000	\$17 547 plus 37c for each \$1 over \$80 000
\$180 001 and over	\$54 547 plus 45c for each \$1 over \$180 000

In addition, a compulsory Medicare levy is charged to cover basic medical costs. This is calculated at 1.5% of taxable income.

In the 2013-14 financial year, Bruce earned a gross salary of \$89 128. In addition, he earns \$10 700 from an investment property, and is allowed \$22 750 in deductions.

i. What is Bruce's taxable income? **1**

ii. Calculate the PAYG tax payable. **2**

iii. Find the Medicare levy that Bruce will also pay. **1**

iv. If his employer has withheld \$18 567.70, will Bruce receive a tax refund or be liable to pay more tax? By how much? **2**

Question 9 (13 Marks) Commence a NEW page. **Marks**

(a) A person earns a salary of $\$x$ in the first year of work. He obtains a pay rise of $\$y$ each subsequent year. **2**

How much has that person earned in total over 3 years, starting from the time he was employed?

(b) The value of a certain fraction becomes $\frac{1}{5}$ when 1 is added to the numerator. **3**

If 1 is subtracted from the denominator, it becomes $\frac{1}{7}$.

What is the value of this fraction?

(c) Expand and fully simplify: $\left[x-\left(1-\sqrt{5}\right)\right]\left[x+\left(1-\sqrt{5}\right)\right]$. **2**

(d) i. Solve simultaneously: **2**

$$\begin{cases} y = \dfrac{3}{x} \\ x + y = 0 \end{cases}$$

ii. What geometric implication does the solution have? **1**

(e) A worker works for three days on a casual basis for 10, 7 and 9 hours respectively. **3**

The first eight hours is paid the normal rate, and thereafter at time-and-a-half. Find the base rate of pay if she earns \$660 over the course of three days.

↓ **End of paper.** ↓

MR a Suggested Sol^ns

1a) 139700 — 1

b) 170 — 1

c) 0.423 — 1

d) $7x^8$ — 1

e) $\frac{3}{x^2}$ — 1

f) $7\sqrt{3} = \sqrt{147}$

$a = 147$ — 1

g) 750×1.1225 — 1

$\$841.88$

h) $\frac{98 \times 60 \times 60}{1000}$

$= 352.8$ km/h — 1

i) $\frac{30000}{375} = 80$ — 1

j) i) $10\sqrt{7}$ — 2

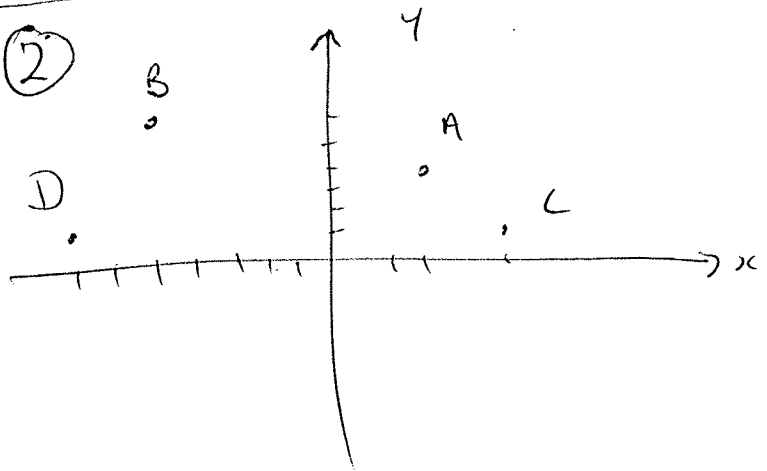
ii) $150 - 40\sqrt{6} + 16$

$= 166 - 40\sqrt{6}$ — 2

k) $\frac{5(4+\sqrt{3})}{13}$ — 2

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(2)



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q) i) $m_{CD} = 0$ — 1

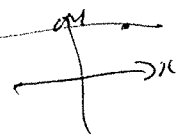
ii) Midpt AD $= \left(\frac{2+(-7)}{2}, \frac{4+1}{2}\right)$

$= \left(\frac{-5}{2}, \frac{5}{2}\right)$ — 2

iii) $AB = \sqrt{2^2 + (-7)^2}$

$= \sqrt{53}$ — 2

b)



$y = 5$ — 1

c) $y = \frac{-2x}{3} + \frac{6}{3}$

$m = -\frac{2}{3}$ so gradt $-\frac{2}{3}$ — 1

$b = 2$ yintcpt $(0,2)$ — 1

d) $y = \frac{2}{3}x + -3$

$y = \frac{2}{3}x - 3$ — 2

$(2x - 3y - 9 = 0)$

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(3) a) $6m^2 - 9m + 10m - 15$

$6m^2 + m - 15$ — 1

b) $\frac{3b}{c^2}$ — 1

c) $\frac{(6x+3)(6x-8)^{x-24}}{6^{3x-2}(2x+1)^{t-5}(3x-4)}$ — 2

(3) a) i) 3^{1-4} — 1

ii) $125n^6$ — 1

iii) $\frac{ab(1-c)}{2ac(1-c)}$ — 1

$= \frac{b}{2c}$ — 1

iv) $\frac{6x-18-5x+20}{30}$ — 1

$\frac{x+2}{30}$ — 1

e) ~~$8x = 12x$~~

$-12 = 3x$

$x = -4$ — 1

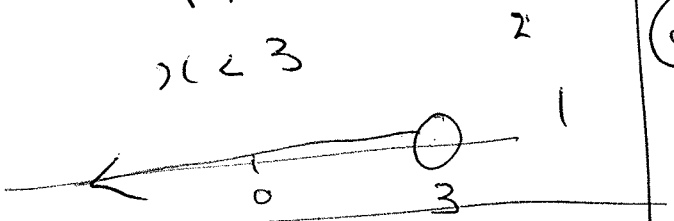
$S = 2 \times (-4)^2$

$= 32$ — 1

f) $3x+5 > 6x-4$

$9 > 3x$

$x < 3$



2

1

(4) a) $64 = 2x - p$ — 1

$p = 2x - 64$ — 1

b) i) $5(3x+2) = 2x - 40$ — 1

$15x + 10 = 2x - 40$

$13x = -50$

$x = -\frac{50}{13}$ — 1

ii) $8 - 3 = 18x$ — 1

$18x = 5$ — 1

$x = \frac{5}{18}$ — 1

iii) $5x^2 - 100x = 0$ — 1

$5x(x-20) = 0$ — 1

$x = 0 \quad x = 20$ — 1

Isolate — 1 mark

c) $32 = \frac{8}{1-r}$ — 1

$1 - r = \frac{1}{4}$

$r = \frac{3}{4}$ — 1

d) $4x = 12$

$x = 3$ — 1

$3 + 2y = 5$

$2y = 2$

$y = 1$ — 1

$(x, y) = (3, 1)$ — 1

(5) a) $A = \frac{1}{2} \times 7 \times 10$

$= 35\text{cm}^2$ — 1

b) $l = \sqrt[3]{15625}$

$= 25\text{cm}$ — 1

c) $C = \pi \times 2 \times r$

$= 12800\pi\text{ km}$ — 1

(40212)

5D) $V = \pi rs + \pi r^2$ 1

$= \pi \times 7 \times 25 + \pi \times 49$

$= 175\pi + 49\pi$ 1

$= 224\pi \text{ cm}^2$ 1

(-1 if no units)

e) i) $V = A \times h$

$= \frac{1}{2}(2.1 + 1.3) \times 8 \times 3$ -1

$= 4(3.4) \times 3$

$= 40.8 \text{ m}^3$ -1

ii) 40 800 L — 1

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6) a i) $(2n-4) \times 90 = (n-2) \times 180$ -1

ii) EQUILATERAL -1
(must be spelt correctly)

iii) congruent — 1

iv) EQUAL, PARALLEL -2

b) i) In $\triangle ABE$ & $\triangle BAD$

AB is common -1

BE = AD (Data) -1

$\angle AEB = \angle ADB$ (Data) -1
$= 90^\circ$

$\therefore \triangle ABE \equiv \triangle BAD$ (RHS) -1

(no reasons or some omitted 2/4)

ii) $\angle CAB = \angle CBA$

corresponding sides of congruent $\triangle$s

$\therefore \triangle ABC$ is isosceles

(2 $\angle$'s equal) — 1

7) (Don't penalise for rounding)

a) $\cos 25 = \frac{x}{40}$ — 1

$x = 40 \cos 25$

$= 36.3 \text{m}$ -1

b) $\sin 50 = \frac{20}{x}$ — 1

$x = \frac{20}{\sin 50}$

$= 26.1$ ---1

c) $\tan\theta = \frac{18}{32}$ --1

$\theta = \tan^{-1}\left(\frac{18}{32}\right)$

$= 29^\circ$ ---1

b) $\tan 10 = \frac{112}{y}$

$y = \frac{112}{\tan 10}$ —— 1

$\tan 6 = \frac{112}{x+y}$ — 1

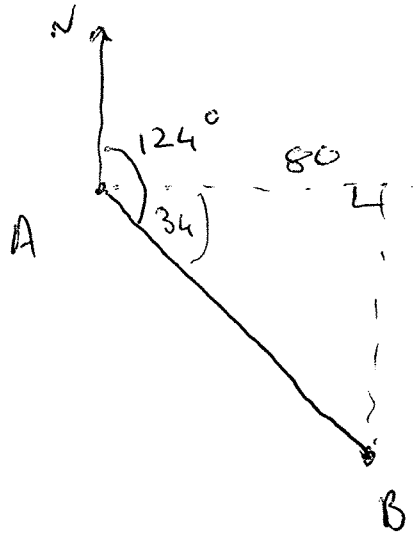
$x+y = \frac{112}{\tan 6}$

$x = \frac{112}{\tan 6} - y$ — 1

$= 430.4$

$= 430 \text{ km}.$

c) i)



−1

ii) $\cos 34 = \frac{80}{AB}$ — 1

$AB = \frac{80}{\cos 34}$

$= 96.5$ km — 1

So impossible for max to Average 80% — 1

c) (TAKE ANSWERS TO THE NEAREST $)

i) $89128 + 10700 - 22750$

$= \$77078$ — 1

ii) $\$3572 + 40078 \times .325$ — 1

$\$13025.35$

$\$16597.35$ — 1

iii) 77078×0.015

$= \$1156.17$ — 1

iv) REFUND — 1

$\$1970.35 - 1156.17$

$\$814.18$

(8) a) i) MODE = 8 — 1

ii) MEDIAN = 7.5 — 1

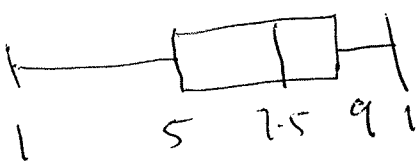
iii) MEAN $= (1+2+6+12+20+24+35+72+72+30) \div 40$

$= 6.85$ — 1

iv) Q_1 (Lower Quartile) = 5 — 1

Q_3 (upper Quartile) = 9 — 1

v)



— 2

b) $4 \times 73 = 292$

$5 \times 80 = 400$

∴ Mav needs $400 - 292$

108 — 1

(9) a) $x + x+4 + x+24$ — 1

∴ Total cost $(3x+34)$ — 1

b) $\frac{x+1}{4} = \frac{1}{5}$ $\frac{x}{4-1} = \frac{1}{7}$ — 1

$5x+5 = 4$ $7x = 4-1$

$4 = 7x+1$

∴ $5x+5 = 7x+1$

$4 = 2x$

$x = 2$

$4 = 15$

∴ Each $\frac{2}{15}$ — 1

c) $x^2 - (1-\sqrt{5})^2$ — 1

$x^2 - (6-2\sqrt{5})$

$x^2 - 6 + 2\sqrt{5}$ — 1

d) i) $y = \frac{3}{x}$ $\quad x + y = 0$

$\therefore \quad x + \frac{3}{x} = 0$

$x^2 + 3 = 0$

$x^2 = -3$ — 1

no Soln — 1

(must say no soln)

ii) Graphs do not intersect — 1

e) Let x be rate — 1

$8x + 2 \times \frac{3}{2}x + 7x + 8x + \frac{3}{2}x$

$8x + 3x + 7x + 8x + \frac{3x}{2}$

$\therefore \quad \frac{55x}{2} = 600$ — 1

$x = \frac{1200}{55}$

$= 24$

— 1

∴ Box Rate $24