Name _____ Teacher _____

SYDNEY TECHNICAL HIGH SCHOOL

MATHEMATICS – YEAR 9 – MAY COMMON TEST, 2017

Time allowed: 70 minutes

Instructions: * Calculators may be used.

* Necessary working must be shown in the spaces provided.
* Full marks may not be awarded for careless, illegible or messy working.
* Marks are shown next to questions.
* Use blue or black pen only.

Question	Topic	Marks
1	Number	/12
2	Algebra	/12
3	Geometry	/12
4	Indices	/12
5	Surds	/12
6 a	Number	/3
b	Algebra	/3
c	Indices	/3
d	Surds	/3
e	Geometry	/3

TOTAL /75

QUESTION 1 – NUMBER (12 marks) **ANSWERS**

a) Round off 6.547 correct to :

i) 2 decimal places. _____ 1

ii) 2 significant figures. _____ 1

b) Rewrite as ordinary numerals :

i) 4.2×10^3 _____ 1

ii) 3.6×10^{-2} _____ 1

c) Rewrite 63.7×10^4 in correct scientific notation _____ 1

d) Rewrite in scientific notation :

i) 842 _____ 1

ii) 0.0025 _____ 1

e) Write 267900 correct to 3 significant figures. _____ 1

f) How many significant figures are used to write :

i) 75.05 ? _____ 1

ii) 7500 ? _____ 1

g) A megalitre is 10^6 litres. How many litres in $\frac{1}{2}\%$ of a megalitre? _____ 1

h) Write all the irrational numbers from these :

-3 , π , $\frac{2}{7}$, $0.\dot{6}$, $\sqrt{9}$, $\sqrt{10}$, $\frac{0}{1}$, $\sqrt{0}$ _____ 1

QUESTION 2 – ALGEBRA (12 marks)

a) If $m = -2,\ n = -3$, what is the value of $mn(m-n)$? _____ 1

b) Simplify :

i) $3xy - 4x + x - xy$ _____

ii) $4ab \times 3 \div 6a$ _____

iii) $\frac{2a}{3} + \frac{a}{3}$ _____ 3

c) Express as single, simple fractions :

i) $\frac{5}{2x} + \frac{2x}{3y}$ _____

ii) $\frac{4}{5y} \div \frac{7}{10y^2}$ _____ 3

iii) $10 - \frac{1}{x}$ _____

d) Expand and simplify where [possible :

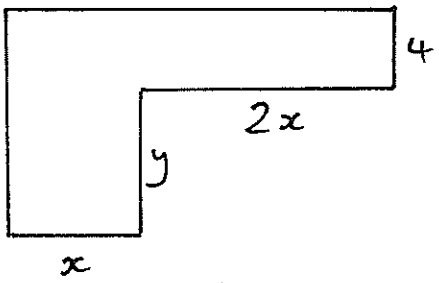
i) $2x(3-x)$ _____

ii) $4(1+2a) - 3(a-1)$ _____ 4

iii) $(5+y)^2$ _____

iv) $(2m+1)(m-3)$ _____

e) Find the perimeter of this shape, simplifying your answer. 1



QUESTION 3 – GEOMETRY (12 marks)

a) For an octagon, the sum of all :

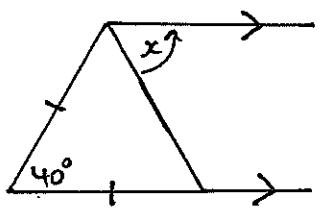
i) interior angles is _____ degrees. 1

ii) exterior angles is _____ degrees. 1

b) Find the size of each interior angle of a regular icosagon (20 sides) 1

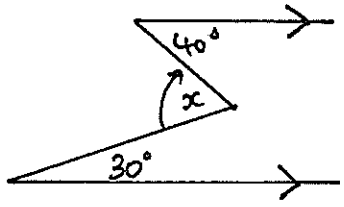
c) Find the size of the angle marked x in each diagram below. Reasons are not required. 3

i)



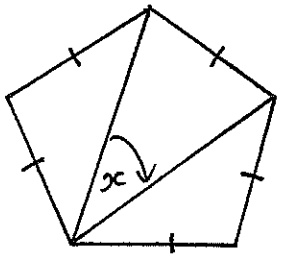
Answer _____

ii)



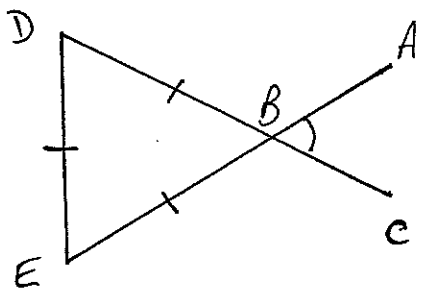
Answer _____

iii)

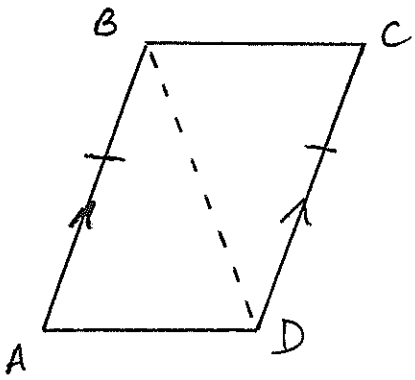


Answer _____

d) Find the size of $\angle ABC$, giving reasons : 2



e) i) Prove that the two triangles are congruent : 3



ii) From part i), what is the reason now for $\angle BAD = \angle DCB$? 1

QUESTION 4 – INDICES (12 marks)

a) Simplify: i) $3x^3 \times 4x^4$ ii) $m^{100} \div (m^4)^5$ 6

iii) $3m^7 - m^7$ iv) $\dfrac{ab^2}{(2ab)^3}$

v) $\sqrt{a^{36}}$ vi) $4x^0 \times 4x^1$

b) Evaluate $16^{-1/2} \times 10^{-1}$ 1

c) MULTIPLE CHOICE – Write A, B, C or D only:

i) $7^{-2} = ?$

A. $\frac{1}{14}$ B. -49 C. $\frac{-1}{49}$ D. $\frac{1}{49}$ _____ 1

ii) $3\sqrt{x} = ?$

A. $x^{1/3}$ B. $3x^{1/2}$ C. $x^{2/3}$ D. $\frac{3x}{2}$ _____ 1

iii) $\frac{1}{2x} = ?$

A. $\frac{1}{2}x^{-1}$ B. $2x^{-1}$ C. $-2x$ D. x^{-2} _____ 1

iv) $m^{5/3} = ?$

A. $\frac{5m}{3}$ B. $\frac{3m}{5}$ C. $(\sqrt[3]{m})^5$ D. $(\sqrt[5]{m})^3$ _____ 1

v) $2a^{-10} = ?$

A. $\frac{2}{a^{10}}$ B. a^{-20} C. $\frac{1}{2a^{10}}$ D. $-20a$ _____ 1

QUESTION 5 – SURDS (12 marks)

a) Simplify: i) $\sqrt{50}$ _____ ii) $6\sqrt{7}+\sqrt{7}$ _____ iii) $\sqrt{20}-\sqrt{5}$ _____ 3

b) Simplify : $\frac{3\times 2\sqrt{10}}{2\sqrt{5}\times 6\sqrt{3}}$ _____ 2

c) Expand and simplify :

i) $3\sqrt{2}(4\sqrt{2}-\sqrt{18})$ 2

ii) $(\sqrt{3}+4)^2$ 2

iii) $(2\sqrt{5}+\sqrt{2})(2\sqrt{5}-\sqrt{2})$ _____ 2

d) Express $\frac{3+\sqrt{2}}{\sqrt{3}}$ with a rational denominator. 1

QUESTION 6 – MIXED/HARDER (15 marks)

a) (Number)

i) Which numeral represents " a tenth of 1000^{20}" ? 1

A. 1000^2 B. 100^{20} C. 100^2 D. 10^{59} E. 10^{22} Answer _____

ii) If $a = -2$, $b = -1$, what is the value of $\frac{5a^2b^3}{2(a+b)^{-1}}$? 1

iii) Calculate $\frac{(3.26 \times 10^{-3}) \times (4.3 \times 10^2)}{(4.9 \times 10^{-2})^3}$. 1

Write your answer using 3 significant figures.

b) (Algebra)

i) Expand and simplify $(a-3b)^2 - (b+3a)^2$ 2

ii) Express $\frac{2x}{3} - \frac{x+1}{6}$ as a single, simple fraction. 1

c) (Indices)

i) Express $2^n + 2^n$ in simplest index form.

ii) Simplify $\sqrt{\frac{a^m}{a^{-m}}}$ 3

iii) If $x^{-3/2} = 64$, find the value of x.

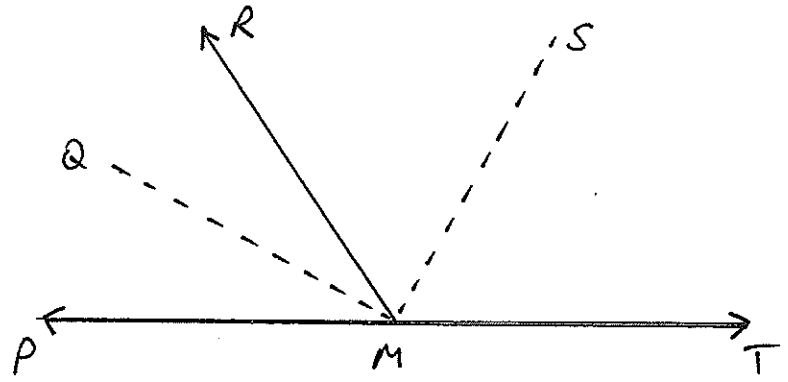
d) (Surds)

i) Simplify $\frac{4+\sqrt{28}}{14}$ 1

ii) Write $\frac{\sqrt{2}+4}{\sqrt{5}} + \frac{3-\sqrt{3}}{2}$ as a single, simple fraction. Leave your answer with a rational denominator. 2

e) (Geometry)

i)



3

PMT is a straight line. QM bisects $\angle PMR$ and SM bisects $\angle RMT$.

Prove that $\angle QMS$ is a right angle.

END OF TEST.

QUESTION 1 – NUMBER (12 marks)

ANSWERS

ANSWERS

a) Round off 6.547 correct to :

i) 2 decimal places. — 6.55 — 1

ii) 2 significant figures. — 6.5 — 1

b) Rewrite as ordinary numerals :

i) 4.2×10^3 — 4200 — 1

ii) 3.6×10^{-2} — 0.036 — 1

c) Rewrite 63.7×10^4 in correct scientific notation — 6.37×10^5 — 1

d) Rewrite in scientific notation :

i) 842 — 8.42×10^2 — 1

ii) 0.0025 — 2.5×10^{-3} — 1

e) Write 267900 correct to 3 significant figures. — 268000 — 1

f) How many significant figures are used to write :

i) 75.05 ? — 4 — 1

ii) 7500 ? — 2 — 1

g) A megalitre is 10^6 litres. How many litres in $\frac{1}{2}\%$ of a megalitre? — 5000 (or 5×10^3) — 1

h) Write all the irrational numbers from these :

-3, π, $\frac{2}{7}$, $0.\dot{6}$, $\sqrt{9}$, $\sqrt{10}$, $\frac{0}{1}$, $\sqrt{0}$ — π, $\sqrt{10}$ (must have both) — 1

QUESTION 2 – ALGEBRA ( ) marks)

a) If $m = -2$, $n = -3$, what is the value of $mn(m-n)$? — 6 — 1

b) Simplify :

i) $3xy - 4x + x - xy$ — $2xy - 3x$

ii) $4ab \times 3 \div 6a$ — $2b$

iii) $\frac{2a}{3} + \frac{a}{3}$ — a (not $\frac{3a}{3}$) — 3

c) Express as single, simple fractions :

i) $\frac{5}{2x} + \frac{2x}{3y}$ — $\frac{15y + 4x^2}{6xy}$

ii) $\frac{4}{5y} \div \frac{7}{10y^2}$ — $\frac{8y}{7}$ — 3

iii) $10 - \frac{1}{x}$ — $\frac{10x - 1}{x}$

d) Expand and simplify where [possible :

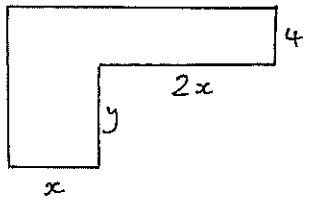
i) $2x(3-x)$ — $6x - 2x^2$

ii) $4(1+2a) - 3(a-1)$ — $7 + 5a$ — 4

iii) $(5+y)^2$ — $25 + 10y + y^2$

iv) $(2m+1)(m-3)$ — $2m^2 - 5m - 3$

e) Find the perimeter of this shape, simplifying your answer. 1



$6x + 2y + 8$

QUESTION 3 – GEOMETRY (12 marks)

a) For an octagon, the sum of all :

i) interior angles is 1080 degrees. 1

ii) exterior angles is 360 degrees. 1

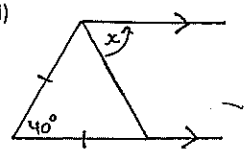
b) Find the size of each interior angle of a regular icosagon (20 sides) 1

$18 \times 180° = 3240°$

$\therefore$ each angle $= 162°$

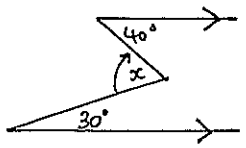
c) Find the size of the angle marked x in each diagram below. Reasons are not required. 3

i)



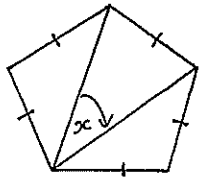
Answer 70°

ii)



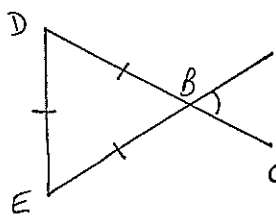
Answer 70°

iii)



Answer 36°

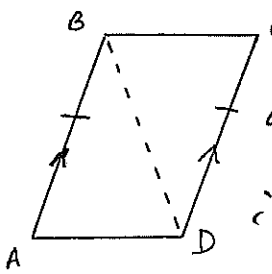
d) Find the size of $\angle ABC$, giving reasons : 2



$\angle DBE = 60°$ (angle of equilateral triangle)

$\therefore \angle ABC = 60°$ (vertically opposite angles)

e) i) Prove that the two triangles are congruent : 3



$AB = CD$ (given)

BD is common

$\angle ABD = \angle BDC$ (alternate angles, parallel lines)

$\therefore \triangle ABD \equiv \triangle CDB$ (SAS)

ii) From part i), what is the reason now for $\angle BAD = \angle DCB$? 1

corresponding angles in congruent triangles.

QUESTION 4 – INDICES (12 marks)

a) Simplify: i) $3x^3 \times 4x^4$ $12x^7$ ii) $m^{100} \div (m^4)^5$ m^{80} 6

iii) $3m^7 - m^7$ $2m^7$ iv) $\frac{ab^2}{(2ab)^3}$ $\frac{1}{8a^2b}$

v) $\sqrt{a^{36}}$ a^{18} vi) $4x^0 \times 4x^1$ $16x$

b) Evaluate $16^{-1/2} \times 10^{-1}$ $\frac{1}{40}$ (or 0·025) 1

c) MULTIPLE CHOICE – Write A, B, C or D only:

i) $7^{-2} = ?$

A. $\frac{1}{14}$ B. -49 C. $\frac{-1}{49}$ D. $\frac{1}{49}$ D 1

ii) $3\sqrt{x} = ?$

A. $x^{1/3}$ B. $3x^{1/2}$ C. $x^{2/3}$ D. $\frac{3x}{2}$ B 1

iii) $\frac{1}{2x} = ?$

A. $\frac{1}{2}x^{-1}$ B. $2x^{-1}$ C. $-2x$ D. x^{-2} A 1

iv) $m^{5/3} = ?$

A. $\frac{5m}{3}$ B. $\frac{3m}{5}$ C. $(\sqrt[3]{m})^5$ D. $(\sqrt[5]{m})^3$ C 1

v) $2a^{-10} = ?$

A. $\frac{2}{a^{10}}$ B. a^{-20} C. $\frac{1}{2a^{10}}$ D. $-20a$ A 1

QUESTION 5 – SURDS (12 marks)

a) Simplify: i) $\sqrt{50}$ $5\sqrt{2}$ ii) $6\sqrt{7}+\sqrt{7}$ $7\sqrt{7}$ iii) $\sqrt{20}-\sqrt{5}$ $\sqrt{5}$ 3

b) Simplify: $\frac{3\times 2\sqrt{10}}{2\sqrt{5}\times 6\sqrt{3}}$ $\frac{\sqrt{10}}{2\sqrt{15}} = \frac{\sqrt{2}}{2\sqrt{3}}$ 2

or $\frac{1}{2}\sqrt{\frac{2}{3}}$

or $\frac{\sqrt{6}}{6}$

c) Expand and simplify:

i) $3\sqrt{2}(4\sqrt{2}-\sqrt{18})$ 2

$24-3\sqrt{36}$

$=24-18$

$=6$

ii) $(\sqrt{3}+4)^2$ 2

$3+8\sqrt{3}+16$

$=19+8\sqrt{3}$

iii) $(2\sqrt{5}+\sqrt{2})(2\sqrt{5}-\sqrt{2})$ $20-2=18$ 2

d) Express $\frac{3+\sqrt{2}}{\sqrt{3}}$ with a rational denominator. $\frac{3\sqrt{3}+\sqrt{6}}{3}$ 1

QUESTION 6 – MIXED/HARDER (15 marks)

a) (Number)

i) Which numeral represents " a tenth of 1000^{20}" ? 1

A. 1000^2 B. 100^{20} C. 100^2 D. 10^{59} E. 10^{22} Answer D

ii) If $a=-2$, $b=-1$, what is the value of $\frac{5a^2b^3}{2(a+b)^{-1}}$? 30 1

iii) Calculate $\frac{(3.26\times 10^{-3})\times(4.3\times 10^2)}{(4.9\times 10^{-2})^3}$. 11900 1

Write your answer using 3 significant figures.

b) (Algebra)

i) Expand and simplify $(a-3b)^2-(b+3a)^2$ 2

$a^2-6ab+9b^2-(b^2+6ab+9a^2)$

$=a^2-6ab+9b^2-b^2-6ab-9a^2$

$=-8a^2-12ab+8b^2$

ii) Express $\frac{2x}{3} - \frac{x+1}{6}$ as a single, simple fraction. 1

$\frac{4x}{6} - \frac{x+1}{6}$

$= \frac{3x-1}{6}$

c) (Indices)

i) Express $2^n + 2^n$ in simplest index form.

$2 \times 2^n = 2^{n+1}$

ii) Simplify $\sqrt{\frac{a^m}{a^{-m}}}$ 3

$\sqrt{a^{2m}}$

$= a^m$

iii) If $x^{-3/2} = 64$, find the value of x.

$x = (64)^{-2/3}$

$= \frac{1}{16}$

d) (Surds)

i) Simplify $\frac{4+\sqrt{28}}{14}$ 1

$\frac{4+2\sqrt{7}}{14}$

$= \frac{2+\sqrt{7}}{7}$

ii) Write $\frac{\sqrt{2}+4}{\sqrt{5}} + \frac{3-\sqrt{3}}{2}$ as a single, simple fraction. Leave your answer with a rational denominator. 2

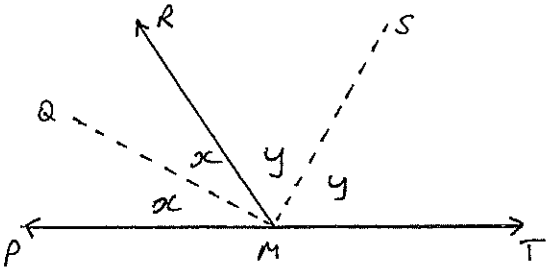
$\frac{2\sqrt{2}+8+3\sqrt{5}-\sqrt{15}}{2\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$

$= 2\sqrt{10} + 8\sqrt{5} + 15 - 5\sqrt{3}$

10

e) (Geometry)

i) 3



PMT is a straight line. QM bisects $\angle PMR$ and SM bisects $\angle RMT$.

Prove that $\angle QMS$ is a right angle.

Mark in x, y for equal angles.

$2x + 2y = 180°$ (PMT is a straight angle)

$\therefore x + y = 90°$

$\therefore \angle QMS$ is a right angle.

END OF TEST.