



SYDNEY GIRLS HIGH SCHOOL

2009

YEAR 9 YEARLY EXAMINATION

# Mathematics

## General Instructions

- Working time – 75 minutes
- Board approved calculators may be used.
- Diagrams are NOT necessarily drawn to scale.
- All necessary working should be shown in every question.
- Start each question on a new page.
- This Exam paper will be collected after the exam.

## Total marks – 100

- Attempt Questions 1 – 5.

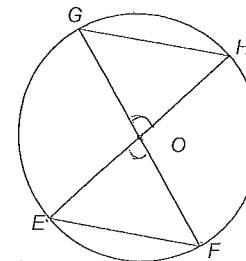
Name: \_\_\_\_\_

Class: \_\_\_\_\_

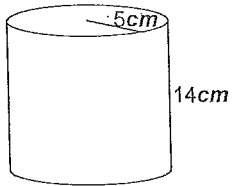
## QUESTION 1

Marks

- a) Simplify  $2a^2 \times 5a^7$  2
- b) Expand and simplify  $(x+3)(2x+1)$  2
- c) Simplify  $\frac{2x}{3} + \frac{x}{12}$  2
- d) Simplify  $\sqrt{2} + \sqrt{18}$  2
- e) Express  $\frac{4\sqrt{3}}{\sqrt{2}}$  with a rational denominator 2
- f) Find the size of each exterior angle of a regular 15 sided polygon. 1
- g) Prove that  $\triangle EOF \cong \triangle GOH$ . (O is the centre of the circle. EH and GF are straight lines) 3



h) Find the surface area of the cylinder below.



Marks

3

i) A spinner is spun 100 times and the results of each spin are listed in the table below. (The areas for each colour are not necessarily the same)

3

Colour	Frequency
Blue	12
Red	26
Orange	5
Green	32
Black	25

Based on these results what is the probability that the next spin will be:

- Blue?
- Red or black?
- Neither red nor black?

### QUESTION 2

a) For the straight line  $3y - 2x + 12 = 0$  state:

2

- The  $y$  intercept.
- The gradient.

b) Sketch  $y = 2x + 6$  clearly showing its intercepts with the  $x$  and  $y$  axes.

2

c) For the coordinates A(-3, 2) B(5, -10) and C(-7, 9) find:

Marks

10

- The midpoint of the interval AB.
- The length of the interval BC.
- The gradient of the line BC.
- ~~iv.~~ The equation of the line BC.
- ~~v.~~ The equation of the line passing through A and perpendicular to BC.

d) Sketch the region described by the intersection of  $y < x + 4$  and  $x > 2$ .

3

e) For the scores listed below find:

3

3, 5, 1, 9, 6, 11, 14

- The mean
- The range
- The median

### QUESTION 3

a) Fully factorise the following:

11

- $2cd + 6c^2$
- $4x + xy - 8 - 2y$
- $121 - x^2$
- $(a+b)^2 - 3(a+b)$
- $x^2 - 4x - 32$
- $18x^2 + 48x + 24$

b) Simplify  $\frac{2}{(a+8)(a-2)} - \frac{1}{a^2+16a+64}$

Marks

3

c) Solve  $6+8x=10x+12$

2

d) Solve simultaneously:

$$7p-2q=13$$

$$7p+6q=-11$$

3

e) What is the equation of the straight line that is parallel to the x axis and passes through the point (1,2)?

1

**QUESTION 4**

a) Use the frequency distribution table below to answer the following questions.

6

Outcome ( $x$ )	Frequency ( $f$ )	$fx$	$c.f.$
10	5	50	
11	7	77	
12	11	132	
13	6	78	
14	15	210	
15	6	90	
	$\sum f =$	$\sum fx =$	

- Copy and complete the frequency distribution table.
- Calculate the mean of the data
- Find the range
- Find the median score
- Find the mode

b) Alexis earns \$14.75 per hour. Calculate her wages for the week if she works 38 hours at normal time, 7 hours at time and a half and 3 hours at double time.

Marks

2

c) Solve simultaneously:

$$2x+5y=23$$

$$3x-4y=-23$$

3

d) Use the income tax table below to answer the following:

4

Taxable Income	Tax on this income
\$1 - \$6000	Nil
\$6001 - \$20000	17 cents for each dollar over \$6000
\$20001 - \$50000	\$2380 + 30 cents for each \$1 over \$20000
\$50001 - \$60000	\$11380 + 42 cents for each \$1 over \$50000
\$60001 and over	\$15580 + 47 cents for each \$1 over \$60000

During 2007 Stefan earned \$58500 as a florist. He had allowable tax deductions of \$3500. During the year he had already paid tax instalments amounting to \$14000. Calculate:

- Stefan's taxable income.
  - The tax payable on his taxable income.
  - Refund due or tax payable.
- e) After a 10% GST was added, the price of a refrigerator was \$987. What was the price of the refrigerator before GST was added?
- f) Diana bought a MAZDA car for \$32000. Four years later she sold the car for \$18000. Find the loss as a percentage of the cost price.
- g) During a 15% off sale at Supre, a dress is advertised at \$60. How much did the dress cost before it was on sale?

**QUESTION 5**

**Marks**

a) Solve  $2(a-4) - 3(2a+1) = 43$

3

b) Solve  $\frac{2x+5}{3} - \frac{3x-4}{7} = 2$

3

c) Make  $a$  the subject of the formula  $\frac{a-m}{m} = \frac{a}{b}$ .

3

d) Solve  $16 - x < \frac{x}{2}$  and graph your solution on a number line.

3

e) Paul is 8 years older than Sam. In 5 years time Paul will be twice as old as Sam was 2 years ago. How old is Sam?

3

f) To find the area of a triangle with sides  $a$ ,  $b$ , and  $c$  units long we find  $s$ , its semi perimeter using the formula  $s = \frac{a+b+c}{2}$  and then use

2

$A = \sqrt{s(s-a)(s-b)(s-c)}$ . A triangle has sides of length 5cm, 6cm and 7cm. Find its semi-perimeter and hence its area.

g) A fraction simplifies to  $\frac{2}{3}$  if the numerator and denominator are both

3

increased by 4. The same fraction simplifies to  $\frac{1}{2}$  when the numerator and denominator are both decreased by 1. Find the fraction.

# Solutions Year 9 Yearly 2009

## Question 1.

a)  $2a^2 \times 5a^7 = 10a^9$

b)  $(x+3)(2x+1) = 2x^2 + x + 6x + 3$   
 $= 2x^2 + 7x + 3$

c)  $\frac{2x}{3} \div \frac{x}{12} = \frac{2x}{3} \times \frac{12}{x}$   
 $= 8$

d)  $\sqrt{2} + \sqrt{18} = \sqrt{2} + 3\sqrt{2}$   
 $= 4\sqrt{2}$

e)  $\frac{4\sqrt{3}}{\sqrt{2}} = \frac{4\sqrt{3}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$   
 $= \frac{4\sqrt{6}}{2}$   
 $= 2\sqrt{6}$

f)  $360^\circ \div 15 = 24^\circ$

g) In  $\triangle EOF$  and  $\triangle GOH$   
 $EO = GO$  (equal radii)  
 $FO = HO$  (equal radii)  
 $\angle EOF = \angle GOH$  (vert. opp.  $\angle$ 's)  
 $\therefore \triangle EOF \cong \triangle GOH$  (SAS)

h)  $S.A = 2\pi r^2 + 2\pi r h$   
 $= 2 \times \pi \times 5^2 + 2 \times \pi \times 5 \times 14$   
 $= 50\pi + 140\pi$   
 $= 190\pi \text{ cm}^2$

i) i.  $P(\text{Blue}) = \frac{12}{100}$   
 $= \frac{3}{25}$

ii.  $P(\text{Red or Black}) = \frac{51}{100}$

iii)  $P(\text{Neither red nor black}) = \frac{49}{100}$

## Question 2.

a)

$$3y - 2x + 12 = 0$$

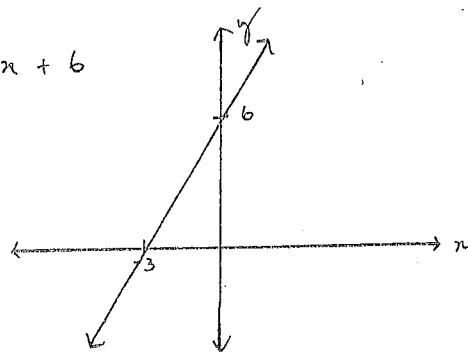
$$3y = 2x - 12$$

$$y = \frac{2}{3}x - 4$$

i)  $y = -4$

ii)  $m = \frac{2}{3}$

b)  $y = 2x + 6$



c) i)  $\left(\frac{-3+5}{2}, \frac{2+(-10)}{2}\right) = (1, -4)$

ii)  $BC = \sqrt{(5-(-7))^2 + (-10-9)^2}$   
 $= \sqrt{144 + 361}$   
 $= \sqrt{505}$   
 $= 22.47 \text{ units (to 2 d.p.)}$

$$\begin{aligned} \text{iii) } m_{BC} &= \frac{9 - (-10)}{-7 - 5} \\ &= \frac{19}{-12} \\ &= -\frac{19}{12} \end{aligned}$$

$$\text{iv) } y - y_1 = m(x - x_1)$$

$$y - (-10) = \frac{-19}{12}(x - 5)$$

$$12(y + 10) = -19(x - 5)$$

$$12y + 120 = -19x + 95$$

$$12y + 19x + 25 = 0$$

$$\text{v) } m_{BC} = -\frac{19}{12}$$

$\therefore$  gradient of line  $\perp$  BC =  $\frac{12}{19}$ .

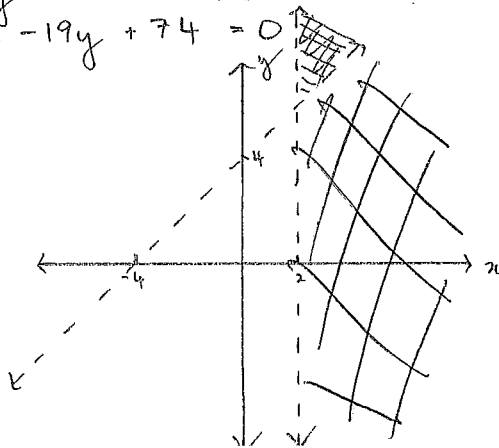
$$y - 2 = \frac{12}{19}(x + 3)$$

$$19(y - 2) = 12(x + 3)$$

$$19y - 38 = 12x + 36$$

$$12x - 19y + 74 = 0$$

d)



$$\text{e) i) } \bar{x} = \frac{49}{7} \text{ not}$$

$$= 7$$

$$\text{ii) Range} = 14 - 1 = 13$$

$$\text{iii) Median} = 6$$

Question 3.

$$\text{a) i) } 2cd + 6c^2 = 2c(d + 3c)$$

$$\text{ii) } 4x + xy - 8 - 2y = x(4+y) - 2(4+y) = (x-2)(4+y)$$

$$\text{iii) } 121 - x^2 = (11-x)(11+x)$$

$$\text{iv) } (a+b)^2 - 3(a+b) = (a+b-3)(a+b)$$

$$\text{v) } x^2 - 4x - 32 = \underline{\underline{-(x+8)(x-4)}} (x-8)(x+4)$$

$$\begin{aligned} \text{vi) } 18x^2 + 48x + 24 &= 6(3x^2 + 8x + 4) \\ &= 6(3x^2 + 6x + 2x + 4) \\ &= 6[3x(x+2) + 2(x+2)] \\ &= 6(3x+2)(x+2) \end{aligned}$$

$$\begin{aligned} \text{b) } \frac{2}{(a+8)(a-2)} - \frac{1}{a^2+16a+64} &= \frac{2}{(a+8)(a-2)} - \frac{1}{(a+8)^2} \\ &= \frac{2(a+8) - 1(a-2)}{(a+8)^2(a-2)} \\ &= \frac{a+18}{(a+8)^2(a-2)} \end{aligned}$$

$$\begin{aligned} \text{c) } 6 + 8x &= 10x + 12 \\ -2x &= 6 \\ x &= -3 \end{aligned}$$

$$\begin{aligned} \text{d) } 7p - 2q &= 13 & \textcircled{1} \\ 7p + 6q &= -11 & \textcircled{2} \\ -8q &= 24 & \textcircled{1} - \textcircled{2} \\ q &= -3 \\ \text{sub } q = -3 &\text{ into } \textcircled{1} \\ 7p + 6 &= 13 \\ 7p &= 7 \\ p &= 1 \end{aligned}$$

$$\text{e) } y = 2.$$

#### Question 4.

a) i)

Outcome	Frequency	$\sum fx$	c.f.
10	5	50	5
11	7	77	12
12	11	132	23
13	6	78	29
14	15	210	44
15	6	90	50
	$\sum f = 50$	$\sum fx = 637$	

$$\begin{aligned} \text{ii) } \bar{x} &= \frac{\sum fx}{\sum f} \\ &= \frac{637}{50} \\ &= 12.74. \end{aligned}$$

$$\begin{aligned} \text{iii) Range} &= 15 - 10 \\ &= 5 \end{aligned}$$

$$\text{iv) median} = 13 \quad (\text{average of } 25^{\text{th}} \text{ and } 26^{\text{th}} \text{ scores})$$

$$\text{v) mode} = 14.$$

$$\begin{aligned} \text{b) Wages} &= \$14.75 \times 38 + \$14.75 \times 1.5 \times 7 + \$14.75 \times 2 \times 3 \\ &= \$803.88 \end{aligned}$$

$$\begin{aligned} \text{c) } 2x + 5y &= 23 & \textcircled{1} \\ 3x - 4y &= -23 & \textcircled{2} \\ 6x + 15y &= 69 & \textcircled{3} \quad (\textcircled{1} \times 3) \\ 6x - 8y &= -46 & \textcircled{4} \quad (\textcircled{2} \times 2) \\ 23y &= 115 & \textcircled{3} - \textcircled{4} \\ y &= 5 \\ \text{sub } y = 5 &\text{ into } \textcircled{1} \\ 2x + 25 &= 23 \\ 2x &= -2 \\ x &= -1. \end{aligned}$$

$$\text{d) i) } \$58500 - \$3500 = \$55000$$

$$\text{ii) } \$11380 + 5000 \times \$0.42 = \$13480$$

$$\begin{aligned} \text{iii) Refund} &= \$14000 - \$13480 \\ &= \$520 \end{aligned}$$

$$\text{e) } \$987 \times \frac{10}{11} = \$897.27$$

$$\begin{aligned} \text{f) } \text{loss} &= \$32000 - \$18000 \\ &= \$14000 \end{aligned}$$

$$\frac{14000}{32000} \times 100 = 43.75\%$$

$$\begin{aligned}
 g) \quad \$60 &= 85\% \\
 \frac{60}{85} &= 1\% \\
 100\% &= \frac{60}{85} \times 100 \\
 &= \$70.59
 \end{aligned}$$

Question 5.

$$\begin{aligned}
 a) \quad 2(a-4) - 3(2a+1) &= 43 \\
 2a - 8 - 6a - 3 &= 43 \\
 -4a - 11 &= 43 \\
 -4a &= 54 \\
 a &= -13\frac{1}{2}
 \end{aligned}$$

$$b) \frac{2x+5}{3} - \frac{3x-4}{7} = 2$$

$$\begin{aligned}
 7(2x+5) - 3(3x-4) &= 2 \times 7 \times 3 \\
 14x + 35 - 9x + 12 &= 42 \\
 5x + 47 &= 42 \\
 5x &= -5 \\
 x &= -1
 \end{aligned}$$

$$c) \frac{a-m}{m} = \frac{a}{b}$$

$$\begin{aligned}
 b(a-m) &= am \\
 ab - bm &= am \\
 ab - am &= bm \\
 a(b-m) &= bm \\
 a &= \frac{bm}{b-m}
 \end{aligned}$$

$$\begin{aligned}
 d) \quad 16 - x &< \frac{x}{2} \\
 16 &< \frac{3x}{2} \\
 32 &< 3x \\
 \frac{32}{3} &< x \\
 x &> 10\frac{2}{3}
 \end{aligned}$$



$$\begin{aligned}
 e) \quad &\text{Let Sam's age now be } x \text{ years} \\
 &\therefore \text{Paul is now } (x+8) \text{ years.} \\
 &\text{- In 5 years Paul's age is } x+13 \\
 &\text{- 2 years ago Sam's age was } x-2 \\
 x+13 &= 2(x-2) \\
 x+13 &= 2x-4 \\
 -x &= -17 \\
 x &= 17. \\
 \therefore \text{Sam is now } 17 \text{ years old.}
 \end{aligned}$$

$$\begin{aligned}
 f) \quad S &= \frac{5+6+7}{2} \\
 &= 9
 \end{aligned}$$

$$\begin{aligned}
 A &= \sqrt{9(9-5)(9-6)(9-7)} \\
 &= \sqrt{216} \\
 &= 14.7 \text{ cm}^2 \text{ (to 1 d.p.)}
 \end{aligned}$$



g) let the fraction be  $\frac{x}{y}$ .

$$\frac{x+4}{y+4} = \frac{2}{3}$$

$$3(x+4) = 2(y+4)$$

$$3x + 12 = 2y + 8$$

$$3x - 2y = -4 \quad (1)$$

$$\frac{x-1}{y-1} = \frac{1}{2}$$

$$2(x-1) = 1(y-1)$$

$$2x - 2 = y - 1$$

$$2x - y = 1 \quad (2)$$

$$4x - 2y = 2 \quad (3) \quad ((2) \times 2)$$

$$x = 6 \quad (3) - (1)$$

sub  $x=6$  into (1)

$$18 - 2y = -4$$

$$-2y = -22$$

$$y = 11$$

$\therefore$  the fraction is  $\frac{6}{11}$