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.
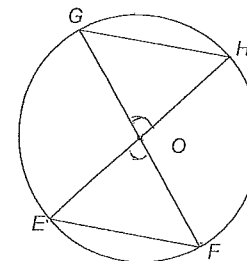
Total marks – 100
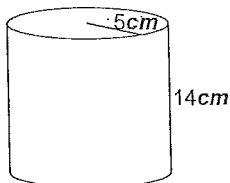- Attempt Questions 1 – 5.

Name:_____   Class:_____

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a) Simplify $2a^2 \times 5a^7$ 2

b) Expand and simplify $(x+3)(2x+1)$ 2

c) Simplify $\dfrac{2x}{3} \div \dfrac{x}{12}$ 2

d) Simplify $\sqrt{2} + \sqrt{18}$ 2

e) Express $\dfrac{4\sqrt{3}}{\sqrt{2}}$ with a rational denominator   2

f) Find the size of each exterior angle of a regular 15 sided polygon.   1

g) Prove that $\triangle EOF \equiv \triangle GOH$. (O is the centre of the circle. EH and GF are straight lines)   3

h) Find the surface area of the cylinder below. 3

i) A spinner is spun 100 times and the results of each spin are listed in the 3
table below. (The areas for each colour are not necessarily the same)

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:

i.   Blue?

ii.   Red or black?

iii.   Neither red nor black?

QUESTION 2

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

   i.   The y intercept.

   ii.   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: 10

   i.   The midpoint of the interval AB.

   ii.   The length of the interval BC.

   iii. 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

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

   i.   The mean

   ii.   The range

   iii. The median

QUESTION 3

a) Fully factorise the following: 11

   i. $2cd + 6c^2$

   ii. $4x + xy - 8 - 2y$

   iii. $121 - x^2$

   iv. $(a+b)^2 - 3(a+b)$

   v. $x^2 - 4x - 32$

   vi. $18x^2 + 48x + 24$

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

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	
	$\sum f =$	$\sum fx =$	

i.   Copy and complete the frequency distribution table.

ii.   Calculate the mean of the data

iii.   Find the range

iv.   Find the median score

v.   Find the mode

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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.

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:

i.   Stefan's taxable income.

ii.   The tax payable on his taxable income.

iii.   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?

1

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.

2

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?

2

QUESTION 5

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

    3

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

    3

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

    3

d) Solve $16-x<\dfrac{x}{2}$ 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 $s=\dfrac{a+b+c}{2}$ and then use $A=\sqrt{s(s-a)(s-b)(s-c)}$. A triangle has sides of length 5cm, 6cm and 7cm. Find its semi-perimeter and hence its area.

    2

g) A fraction simplifies to $\dfrac{2}{3}$ if the numerator and denominator are both increased by 4. The same fraction simplifies to $\dfrac{1}{2}$ when the numerator and denominator are both decreased by 1. Find the fraction.

    3

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

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

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

f) $360° \div 15 = 24°$

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

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

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

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

iii) $P(\text{Neither red nor black}) = \dfrac{49}{100}$
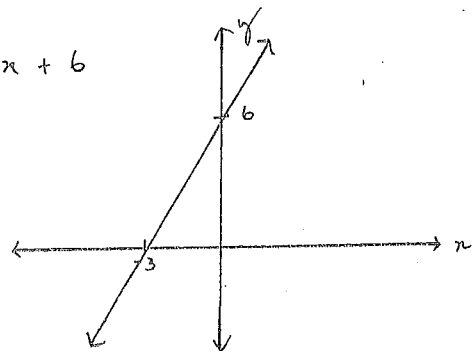
Question 2.

a)
$$3y - 2x + 12 = 0$$
$$3y = 2x - 12$$
$$y = \dfrac{2}{3}x - 4$$

i) $y = -4$

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

b) $y = 2x + 6$

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

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

iii) $m_{BC} = \dfrac{9-(-10)}{-7-5}$

$= \dfrac{19}{-12}$

$= -\dfrac{19}{12}$

iv) $y - y_1 = m(x - x_1)$

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

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

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

$12y + 19x + 25 = 0$

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

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

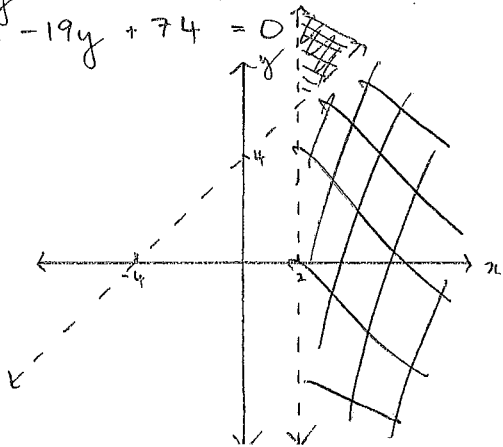$y - 2 = \dfrac{12}{19}(x+3)$

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

$19y - 38 = 12x + 36$

$12x - 19y + 74 = 0$

d)

e) i) $\bar{x} = \dfrac{49}{7}$

$= 7$

ii) Range $= 14 - 1$

$= 13$

iii) Median $= 6$.

Question 3.

a) i) $2cd + 6c^2 = 2c(d + 3c)$

ii) $4x + xy - 8 - 2y = x(4+y) - 2(4+y)$

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

iii) $121 - x^2 = (11-x)(11+x)$

iv) $(a+b)^2 - 3(a+b) = (a+b-3)(a+b)$

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

vi) $18x^2 + 48x + 24 = 6(3x^2 + 8x + 4)$

$= 6(3x^2 + 6x + 2x + 4)$

$= 6[3x(x+2) + 2(x+2)]$

$= 6(3x+2)(x+2)$

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

$= \dfrac{2(a+8) - 1(a-2)}{(a+8)^2(a-2)}$

$= \dfrac{a + 18}{(a+8)^2(a-2)}$

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

$-2x = 6$

$x = -3$

d) $7p - 2q = 13$ ①

$7p + 6q = -11$ ②

$-8q = 24$ ① $-$ ②

$q = -3$

sub $q = -3$ into ①

$7p + 6 = 13$

$7p = 7$

$p = 1$

e) $y = 2$.

Question 4.

a) i)

Outcome	Frequency	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
	$\Sigma f = 50$	$\Sigma fx = 637$	

ii) $\bar{x} = \Sigma fx \div \Sigma f$

$= 637 \div 50$

$= 12.74$.

iii) Range $= 15 - 10$

$= 5$

iv) median $= 13$ (average of 25th and 26th scores)

v) mode $= 14$.

b) Wages $= \$14.75 \times 38 + \$14.75 \times 1.5 \times 7 + \$14.75 \times 2 \times 3$

$= \$803.88$

c) $2x + 5y = 23$ ①

$3x - 4y = -23$ ②

$6x + 15y = 69$ ③ (① $\times 3$)

$6x - 8y = -46$ ④ (② $\times 2$)

$23y = 115$ ③ $-$ ④

$y = 5$

sub $y = 5$ into ①

$2x + 25 = 23$

$2x = -2$

$x = -1$.

d) i) $\$58500 - \$3500 = \$55000$

ii) $\$11380 + 5000 \times \$0.42 = \$13480$

iii) Refund $= \$14000 - \$13480$

$= \$520$

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

f) loss $= \$32000 - \$18000$

$= \$14000$

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

g)
$$\$60 = 85\%$$
$$60/85 = 1\%$$

$$100\% = \frac{60}{85} \times 100$$

$$= \$70.59 \ .$$

Question 5.

a) $2(a-4) - 3(2a+1) = 43$
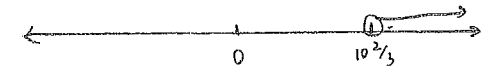$$2a - 8 - 6a - 3 = 43$$
$$-4a - 11 = 43$$
$$-4a = 54$$
$$a = -13\tfrac{1}{2} \ .$$

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

$$7(2x+5) - 3(3x-4) = 2 \times 7 \times 3$$
$$14x + 35 - 9x + 12 = 42$$
$$5x + 47 = 42$$
$$5x = -5$$
$$x = -1$$

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

$$b(a-m) = am$$
$$ab - bm = am$$
$$ab - am = bm$$
$$a(b-m) = bm$$
$$a = \underline{\dfrac{bm}{b-m}}$$

d) $16 - x < \dfrac{x}{2}$
$$16 < \dfrac{3x}{2}$$
$$32 < 3x$$
$$\dfrac{32}{3} < x$$
$$x > 10\tfrac{2}{3}$$

e) — Let Sam's age now be x years
$\therefore$ Paul is now $(x+8)$ years.
— In 5 years Paul's age is $x + 13$
— 2 years ago Sam's age was $x-2$

$$x + 13 = 2(x-2)$$
$$x + 13 = 2x - 4$$
$$-x = -17$$
$$x = 17 \ .$$
$\therefore$ Sam is now 17 years old .

f) $s = \dfrac{5+6+7}{2}$
$$= 9$$

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

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

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

$3(x+4) = 2(y+4)$
$3x + 12 = 2y + 8$
$3x - 2y = -4$ ①

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

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

$4x - 2y = 2$ ③ (② × 2)

$x = 6$ ③ - ①

sub $x = 6$ into ①

$18 - 2y = -4$
$-2y = -22$
$y = 11$

∴ the fraction is $\frac{6}{11}$