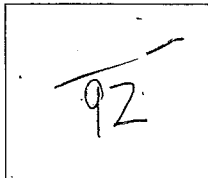**S·H·S**

SYDNEY BOYS HIGH SCHOOL

MOORE PARK, SURRY HILLS

2009

9MaC
Factorisation and Co-ordinate Geometry

Mathematics

General Instructions

- Write using black or blue pen, diagrams may be drawn in pencil
- Calculators may be used.
- **All necessary** working should be shown in all questions if full marks are to be awarded.
- **MARKS MAY NOT BE AWARDED FOR MESSY OR BADLY ARRANGED WORK.**
- Attempt all questions.
- All answers to be given in simplified exact form, unless otherwise stated.

NAME/ _____

Examiner: *A.Ward*

Question.	Answer.		
1. What factor is common to $10x$ and $15y$?		1	
2. Complete the following:			
a) $7x^2y - 2x = \ldots\ldots(7x\ldots\ldots)$		2	
b) $-2x - 10 = \ldots\ldots(x\ldots\ldots)$		2	
3. State whether each statement is <u>T</u>rue or <u>F</u>alse.			
a) $4a^2 - 20ab = -4a(-a - 5b)$		1	
b) $-a^2 + ab = a(b - a)$		1	
c) $-3x^2(2x + 5y) = -6x^2 + 15xy$		1	
4. Factorise:			
a) $x(x + 2) + 5(x + 2)$		1	
b) $3x(x - 11) - 4(x - 11)$		1	
c) $b^2(x + y) - c(x + y)$		1	
5. Factorise then simplify:			
a) $\dfrac{6m + 3n}{10m + 5n}$		2	
b) $\dfrac{18(mr + ms)}{9mr(r + s)}$		3	
6. Find a pair of numbers whose:			
a) Sum is -1 and product is -12.		1	
b) Product is 12 and sum is 8.		1	

7. Factorise the following:

a) $x^2 + 3x + 2$ 2

b) $x^2 - 3x + 2$ 2

c) $6x^2 - 13x + 5$ 3

d) $14a^2 + 40a + 35$ 3

e) $4v^2 - 3v - 1$ 3

f) $\dfrac{3+3t}{18} + \dfrac{5t}{6}$ 3

g) $\dfrac{2x^2 + x - 6}{2x - 3}$ 3

h) $\dfrac{9a^2 - 1}{3a + 1} \times \dfrac{3a + 6}{3a^2 + 5a - 2}$ 3

8. Find the distance between A and B where: Give answer exactly.
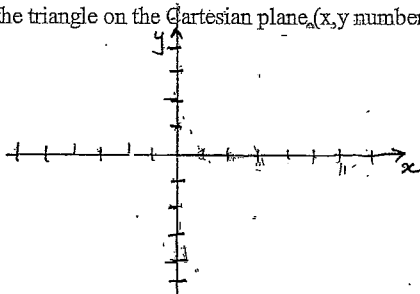
a) A=(5,1) and B=(2,6)   3

b) A=(-7,5) and B=(6,-3)   3

9. Find the mid-point of the lines joining the following co-ordinates:		
a) A(4,5) B(6,-3)	2	
b) C(-8,-5) D(4,5)	2	
c) E(6,-3) F(-8,-5)	2	
10. Write each equation in general form:		
a) $5y = -10x + 7$		
b) $-7y = 3x - 21$		
11. Write each equation in gradient-intercept form:		
a) $5x - y = 6$	2	
b) $3x - 4y = 9$	2	
12. Find the gradient of the lines joining the following pairs of points:		
a) A(3,4) B(9,7)	2	
b) C(9,-2) D(-3,4)	2	

13. Write the equation of the vertical line through the point (6,-2).	2	
14. Show that A(-1,3), B(0,5) and C(1,7) are collinear (lie on the same line)	4	
15. Given points A(-4,7) and B(6,12):		
a) Find the equation of the line AB, in gradient-intercept form.	3	
b) Find the equation of the line perpendicular to AB, passing through the origin in general form.	3	

16. PQR is a triangle with P=(3,4), Q=(-3,-2) and R=(6,-2).

a) Plot the triangle on the Cartesian plane (x,y number plane). | 1

b) Find the gradient of QP | 2

c) Find the length of QP in simplest surd form. | 2

d) Find the co-ordinates of the mid-point of QP. | 2

e) Use the two-point formula to find the equation of the line QP, in gradient-intercept form. | 4

f) Calculate the area of △PQR | 2

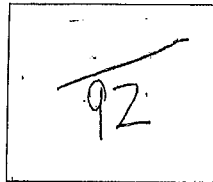g) Determine the equation of the line through the origin and perpendicular to QP. (leave answer in general form) | 3

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- All answers to be given in simplified exact form, unless otherwise stated.

NAME: SOLUTIONS

Examiner: A. Ward

Question.	Answer.		
1. What factor is common to $10x$ and $15y$?	5 ✓	1	1
			5
2. Complete the following:			
a) $7x^2y - 2x = \dots x(7xy - 2\dots)$ ✓		2	4
b) $-2x - 10 = \dots -2(x + 5\dots)$ ✓		2	
3. State whether each statement is <u>True</u> or <u>False</u>.			
a) $4a^2 - 20ab = -4a(-a - 5b)$ False ✓		i F	3
b) $-a^2 + ab = a(b - a)$ True ✓		1 T	
c) $-3x^2(2x + 5y) = -6x^2 + 15xy$ False ✓		1 F	
4. Factorise:			
a) $x(x + 2) + 5(x + 2)$ $(x + 5)(x + 2)$ ✓		1	3
b) $3x(x - 11) - 4(x - 11)$ $(3x - 4)(x - 11)$ ✓		1	
c) $b^2(x + y) - c(x + y)$ $(b^2 - c)(x + y)$ ✓		1	
5. Factorise then simplify:			
a) $\dfrac{6m + 3n}{10m + 5n}$ $= \dfrac{3(2m + n)}{5(2m + n)}$ $= \dfrac{3}{5}$ ✓		2	2
b) $\dfrac{18(mr + ms)}{9mr(r + s)}$ $\dfrac{18m(r + s)}{9mr(r + s)} = \dfrac{18m}{9mr}$ $= \dfrac{2}{r}$ ✓		3	3
6. Find a pair of numbers whose:			
a) Sum is -1 and product is -12. $-4, 3$ ✓		1	2
b) Product is 12 and sum is 8. $6, 2$ ✓		1	

18

7. Factorise the following:

a) $x^2 + 3x + 2$ = $(x+2)(x+1)$ ✓   2

b) $x^2 - 3x + 2$ = $(x-2)(x-1)$ ✓   2

c) $6x^2 - 13x + 5$ = $6x^2 - 10x - 3x + 5$

    30
    -13

= $2x(3x-5) - (3x-5)$

= $(2x-1)(3x-5)$ ✓   3

d) $14a^2 + 40a + 35$ → $(2a^2 + \frac{10}{7}a + 5)$

   = $7(2a^2 + 2a + 5a + 5)$

   = $7(2a(a+1) + 5(a+1))$

   = $7(2a+5)(a+1)$ ✓   3

e) $4v^2 - 3v - 1$ $4v^2 + v - 4v - 1$

   -4
   -3

   = $v(4v+1) - (4v+1)$

   = $(v-1)(4v+1)$ ✓   3

⑬

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f) $\frac{3+3t}{18} + \frac{5t}{6}$ $\frac{3+3t}{18} + \frac{15t}{18}$ 3

   = $\frac{3+18t}{18}$

   = $\frac{3(1+6t)}{18}$ = $\frac{1+6t}{6}$ 2.   2

g) $\frac{2x^2 + x - 6}{2x-3}$ $\frac{2x^2 - 3x + 4x - 6}{(2x-3)}$ 3

   = $\frac{x(2x-3) + 2(2x-3)}{2x-3}$ ✓

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

h) $\frac{9a^2 - 1}{3a+1} \times \frac{3a+6}{3a^2+5a-2}$ = $\frac{(3a-1)(3a+1)}{(3a+1)} \times \frac{3(a+2)}{3a^2+6a-a-2}$ 3

   = $\frac{(3a-1)(3a+1)}{(3a+1)} \times \frac{3(a+2)}{(3a-1)(a+2)}$ $3a(a+2) - (a+2)$

   = 3 ✓   = $(3a-1)(a+2)$ 3

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8. Find the distance between A and B where: Give answer exactly.

a) A=(5,1) and B=(2,6) $\sqrt{(5-2)^2 + (1-6)^2}$ 3
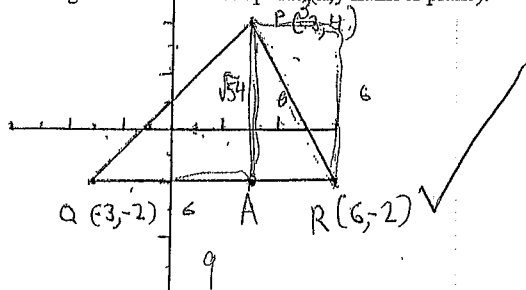
   = $\sqrt{34}$ ✓

b) A=(-7,5) and B=(6,-3) $\sqrt{(-7-6)^2 + (5+3)^2}$ 3

   = $\sqrt{233}$ ✓

⑭

9. Find the mid-point of the lines joining the following co-ordinates:

a) A(4,5) B(6,-3) $(5, 1)$ ✓ 2

b) C(-8,-5) D(4,5) $(-2, 0)$ ✓ 2

c) E(6,-3) F(-8,-5) $(1, -4)$ ✓ 2

6

10. Write each equation in general form:

a) $5y = -10x + 7$ $10x + 5y - 7 = 0$ ✓✓ 2

b) $-7y = 3x - 21$ $3x + 7y - 21 = 0$ ✓✓ 4 4

11. Write each equation in gradient-intercept form:

a) $5x - y = 6$ $y = 5x - 6$ ✓✓ 2

b) $3x - 4y = 9$ $-4y = -3x + 9$

$y = \frac{3}{4}x - 2\frac{1}{4}$ ✓ 2 4

12. Find the gradient of the lines joining the following pairs of points:

a) A(3,4) B(9,7) $\frac{1}{2}$ $\frac{4-7}{3-9}$

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

$\frac{3}{6} = \frac{1}{2}$ ✓ 2

b) C(9,-2) D(-3,4)

$\frac{-2-4}{9+3}$

$= \frac{-6}{12} = -\frac{1}{2}$ ✓ 2 4

18

13. Write the equation of the vertical line through the point (6,-2). 2

$x = 6$

14. Show that A(-1,3), B(0,5) and C(1,7) are collinear (lie on the same line). 4

m of ab $= \frac{5-3}{0--1}$

$= \frac{2}{1} = 2$

m of bc $= \frac{7-5}{1-0}$

$= \frac{2}{1} = 2$

∴ AB is collinear to BC (same gradient & same B as a point) ✓ 4

15. Given points A(-4,7) and B(6,12):

a) Find the equation of the line AB, in gradient-intercept form.

m of ab $= \frac{12-7}{6+4}$

$= \frac{5}{10}$

$= .5$

$y = 0.5x + b$

$7 = -2 + b$ ← subs (-4,7)

∴ $b = 9$

$y = 0.5x + 9$ ✓ 3

b) Find the equation of the line perpendicular to AB, passing through the origin, in general form.

Gradient of line $= \frac{2}{1}$

$2x + y + b = 0$

$0 + 0 + b = 0$

$2x + y = 0$ ✓ 3 3

10

f) Calculate the area of $\triangle$ PQR

$$QR = 6 - -3 = 9$$
$$PA = 4 - -2 = 6$$
$$Area = \frac{1}{2} \times 9 \times 6 = 27 \text{ units}^2$$

②

g) Determine the equation of the line through the origin and perpendicular to QP. (leave answer in general form)

3

gradient of QP is $m = 1$

gradient of this line through $(0,0)$ is -1

$\therefore$ Equ. is $y - 0 = -1(x - 0)$

$$y = -x.$$

or $x + y = 0$

③

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