NAME: ______________________

SCEGGS DARLINGHURST

Preliminary Assessment Task 3

August, 2001

Mathematics

Weighting 15%

TIME ALLOWED: 60 minutes

DIRECTIONS TO CANDIDATES:

- Attempt all questions.
- All part marks are shown on the paper
- START EACH QUESTION ON A NEW PAGE.
- Write your answers on the paper provided.
- Write your name and your teacher's name on each page.
- Approved scientific calculators should be used.
- All necessary working should be shown. Marks may be deducted for careless or badly arranged work.
- Mathematical templates and geometrical instruments may be used.

QUESTION 1 START A NEW PAGE **(9 Marks)**

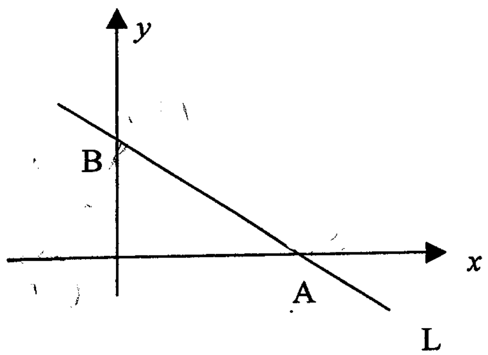


DIAGRAM NOT TO SCALE

The line L shown in the diagram has the equation $6x + 8y - 48 = 0$ and cuts the x axis at A and the y axis at B. Copy or trace the diagram into your writing book.

a) Find the coordinates of A. 1

b) Point C has coordinates (-2,0). By considering the lengths of AB and AC, show that triangle BAC is isosceles. 2

c) Show that the gradient of BC is 3. 1

d) Give an example of a line that would be parallel to BC. 1

e) Calculate the coordinates of D where D is the midpoint of the interval BC. 1

f) Show that AD is the perpendicular bisector of BC. 3

QUESTION 2 START A NEW PAGE **(10 Marks)**

a) DE || AF. Find x, giving reasons. 3

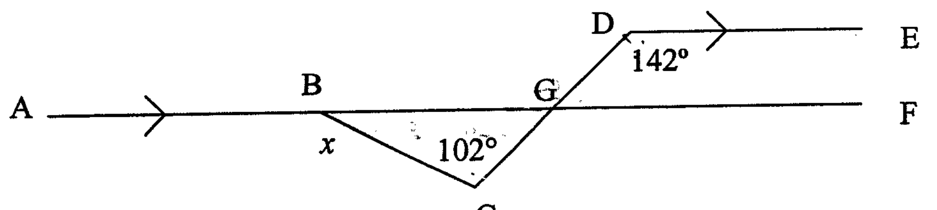
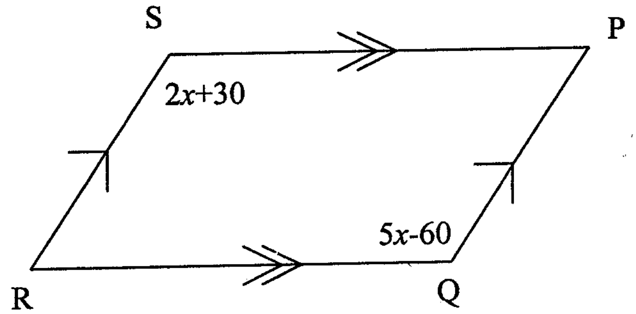


DIAGRAM NOT TO SCALE

b) SPQR is a parallelogram.

DIAGRAM NOT TO SCALE



(i) Find the value of x. 1

(ii) Hence, show that SPQR is a rectangle. 1

c) ABCD is a parallelogram. AC = 9cm. E lies 2cm from C on the line BC and F lies on AD so that FE is parallel to DC. AC and FE meet at G.

i) Draw a diagram showing this information. 2

ii) Prove that triangle AFG is similar to triangle ADC. 3

QUESTION 3 START A NEW PAGE **(9 Marks)**

a) State the equation of this circle. 2

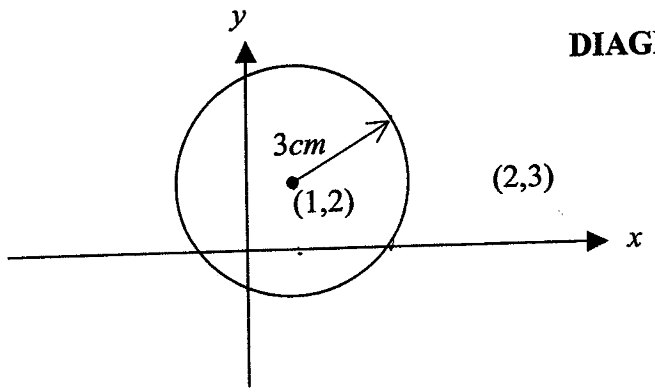


DIAGRAM NOT TO SCALE

b)

(i) Sketch **accurately** $y = |x| - 2$ showing where it crosses the x axis. 2

(ii) **On the same graph**, sketch **accurately** $y = -x^2$. 1

(iii) On your diagram from part b) shade the region given by the following conditions:

$$y \geq -x^2, \quad y \leq 0, \quad y \geq |x| - 2$$

2

(iv) Use your graph to solve this pair of simultaneous equations.

$$y = |x| - 2$$
$$y = -x^2$$

2

QUESTION 4 START A NEW PAGE **(9 Marks)**

a) A function is defined as

$$f(x) = x - 3 \quad \text{for } x < 3$$
$$f(x) = 2x^2 \quad \text{for } 3 \le x < 5$$
$$f(x) = 3 \quad \text{for } x \ge 5$$

Find the value of $f(3) - 2f(6)$. 2

b) What is the domain and range of:

$$f(x) = \frac{1}{\sqrt{x-3}}$$

2

c) The perpendicular distance of the point $(2,k)$ from the line $4x - 3y - 3 = 0$ is 5 units. Find all values of k.

3

d) In the diagram, $\angle \text{BHJ} = 180 - p$, $\angle \text{DJC} = r$ and $\angle \text{EGJ} = q$. Prove that $q = p + r$ giving reasons.

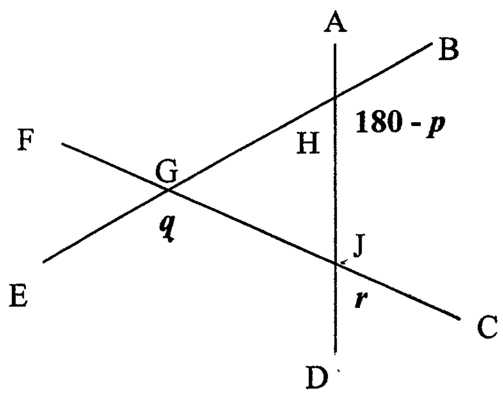


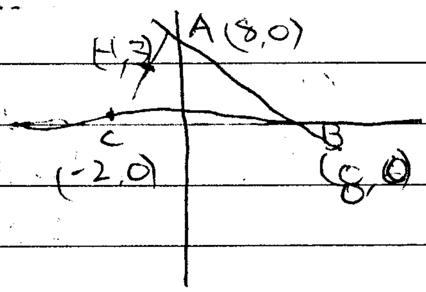
DIAGRAM NOT TO SCALE

2

①

$\frac{8}{9}$ $\frac{3R}{4}$

a) $y = 0$
$6x = 48$
$x = 8$
$\therefore A$ ~~(9/8)~~ $(8, 0)$ ✓ 1



b) ~~BA~~ $d = \sqrt{8^2 + 6^2} = 64 + 36$
$= 10$ units ✓
$AC\,d = \sqrt{10^2 + 0} = \sqrt{100}$
$= 10$ units ✓
$\therefore \triangle BAC$ is isoceles ✓ 2

c) m_{BC} $\frac{y_2 - y_1}{x_2 - x_1} = \frac{0-6}{-2-0} = 3$ ✓ 1   ~~$y - 6 = 3(x$~~
$y = 3x + 6$

d) $y = 3x - 2$ or ✓ 1R
$0 = 3x - y - 2$

e) $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{0-2}{2}, \frac{6}{2}\right) = (-1, 3)$
$\therefore D\,(-1, 3)$ ✓ 1

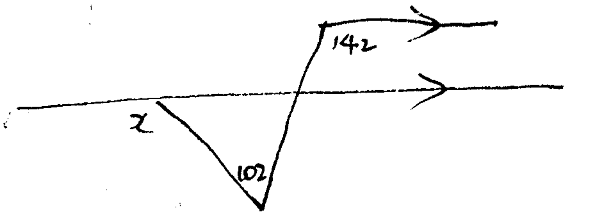
f) $AD_{m_1} = \frac{3-0}{-1-8} = \frac{3}{-9} = -\frac{1}{3}$ ✓

2R

$BC_{m_2} = \frac{0-6}{-2-0} = 3$ ✓

$\therefore m_1 \times m_2 = -1$ $\therefore$ its perpendicular
also D is midpoint of BC
$\therefore$ AD is perpendicular bisector of BC

a)

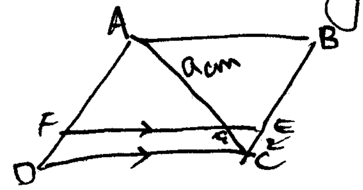


$\angle FGC = 142°$ (corr. $\angle$)
$\angle AGC = 180 - 142°$
$= 38°$ (str $\angle$)
$\therefore x = 38 + 102$ (ext. $\angle$)
$= 140°$

b) i) $2x + 30 = 5x - 60$
$90 = 3x$
$x = 30$

ii) $\therefore 2x + 30° = 90°$
$\therefore$ it's a rectangle

c)



$\angle A$ is common
$\angle AFG = \angle ADC$ (corr $\angle$'s)
$\angle AGF = \angle ACD$ (corr $\angle$'s)
$\therefore \triangle AFG ||| \triangle ADC$ (equiangular)

②

7/10

2R
1C

27/37

a) In DE ∥ AF

1. ∠EDG = ∠FGC (co.int ∠)

~~2. 180-142~~

x = 140° 142°

∠BGC = 1. ~~∠EDG~~ 180 − ∠EDG = 38° (sum of co.int ∠)

2R

2. ∠DGF = ∠BGC (vert. opp ∠)

3. ∠GBC = 40° (sum of Δ) = 180 − (38 + 142) — show working

~~∴ x = 140~~ ∴ 180 − ∠GBC = 140° (str. ∠)

∴ x = 140

b) i) $2x + 30 = 5x - 60$

$-3x = -90$

$x = 30$ ✓

1

ii) Show SPQR is a rectangle

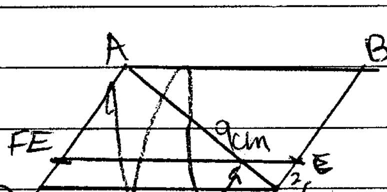
1. ∠PSR = ∠PQR = 90° (opp. sides of parm =) A

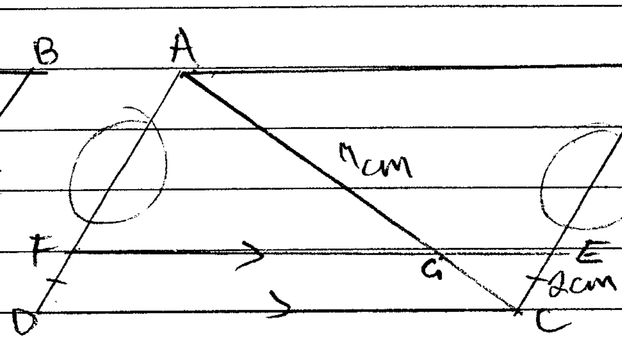
2. SP = RQ (given) S

3. SR = PR (given) S

∴ SPQR is a rectangle, (SAS) test

1

c) i) 



parallel line markings

1C

ii) Prove ΔAFG ||| ADC

1. FG ∥ DC (given)

2. ∠AFG = ∠ADC (corresponding angles equal) ✓ 2 A

3. ∠AGF = ∠ACD (corr. ∠ equal) ✓

∴ ΔAFG ||| ADC (AAS) test

for congruent Δs.

3

$(x-a)(x+a)$

x^2

$\frac{4}{9}$

C R

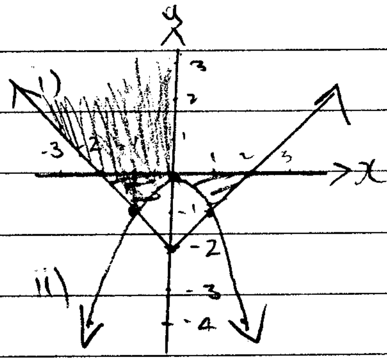
4 0

a) $(x-a)^2+(y-b)^2=r^2$

$(x^2-1)^2+(y^2-3)^2=9$

X

b) i)



i)

	-2			
y	-1	0	1	2
x	-1	-2	-1	0
0				

4

ii)

-2	-1	0	1	2
		0	-1	

iii) $|x|-2=-x^2$

$|x|+x^2=2$ or

$|x|-x^2=-2$

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

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

X

4   5   1K

a) $2 \times 9 = 18$ OR

$f(3) = 2(3)^2$ or $\cancel{2(5)^2}$ $2(5)^2$

$= 18$ $= \cancel{50}$ $= 2 \times 25$

$2f(\cancel{6}) = 2(3)$ $= 50$

$= 6$ $\therefore f(3) - 2f(6)$

$\therefore f(3) - 2f(6)$ $= 44$

$= 12$

2

b) D: ~~$x \ne 3$ or $x = 3$~~ all real x except $x > 3$

R: $y > 0$

2

c) $pd = \left|\frac{ax_1 + by_1 + c}{\sqrt{a^2+b^2}}\right| = \left|\frac{(4\times2) - (3\times K) - 3}{\sqrt{4^2+K^2}}\right| = 5$

$= \left|\frac{8 - 3K - 3}{\cancel{\sqrt{16+K^2}} = 4+K}\right| = 5$

$(4+K)(4+K)$

$16 + 8K + K^2$

$|5 - 3K| = 5\,(\cancel{\sqrt{16+K^2}})(4+K)$

$|5 - 3K| = \cancel{\sqrt{80+5K}}\ 20 + 5K$

$-15 = 8K$

$-15/8 = K$ or

$|5 + 3K| = 20 + 5K$

$-2K = 25$

$K = -25/2 = 12\frac{1}{2}$

$4^2 + 1^2$

$\sqrt{16+1}$

17

5

wrong formula.

d) $180 - p + r = q$

$\angle PJC = \angle HBG = $ (vert opp $\angle$s $=$)

$\angle HGJ = \angle FGE$ (vert opp $\angle$'s) $\angle GHJ = 180 - (180 - p)$

$p + R = 180$

$\therefore \angle EQC = 180^\circ$

$180 - p = q$ (vert. opp $\angle =$)

1