# Carlingford High School

# Year 10 (5.3) Mathematics

marking allocation
1. Trig = TL
2. Inequalities = VL
3. Coord Geo = SA

## Term 3 Examination
## 2018

**Time allowed: 50 minutes**

Student Name: Sample Solutions + Marking Criteria Class: 10MA3__

Circle your teacher: Ms Lobejko Ms Lego Ms Aung

**Instructions:**
- Use black pen. Pencil may be used for graphs and diagrams.
- Board approved calculators may be used.
- Write all answers in spaces provided.
- Show all necessary working.
- Extension questions are marked with an asterisk (*).

| Section | 1. Trigonometry | 2. Solving Inequalities and Regions | 3. Coordinate Geometry | Total |
|---|---|---|---|---|
| Mark | /22 | /13 | /17 | /52 |

Trig Q6(b) is the rounding question

## Section 1: Trigonometry

**Note:** Diagrams are NOT to scale, unless otherwise stated.

**Question 1** **(1 Mark)**

If $\sin A = 0.35$ and $\cos A = 0.21$, find $\tan A$.

$\tan A = \frac{\sin A}{\cos A}$

$= \frac{0.35}{0.21}$

$= 1.\dot{6}$ (or $5/3$) (1)

*must have repeater symbol

**Question 2** **(1 Mark)**

Find the value of $\alpha$ if $\sin 27°21' = \cos \alpha$.

$\cos\alpha = \cos(90° - 27°21')$

$\cos\alpha = \cos(62°39')$

$\therefore \alpha = 62°39'$ (1)

**Question 3** **(1 Mark)**

Solve the equation $\tan\theta = -0.3$ correct to the nearest degree if $\theta$ is between $0°$ and $180°$.

$\theta = \tan^{-1}(-0.3) = -16.699\ldots$

$\theta = 180 - 16.699\ldots = 163°$ (1)

**Question 4** **(2 Marks)**

Find the exact value of $\cos 150°$, showing all working.

$\cos 150° = \cos(180 - 30°)$

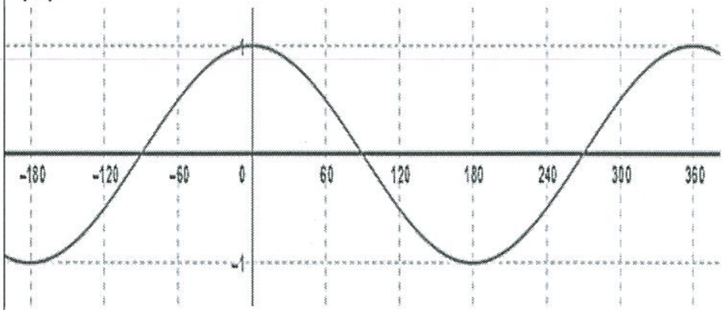
$= -\cos 30°$ (1)

$= -\frac{\sqrt{3}}{2}$ (1)

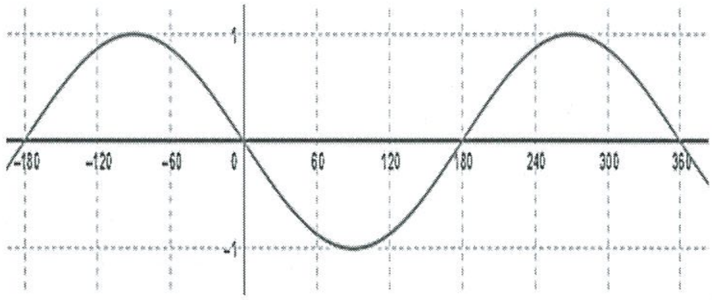
**Question 5** **(1 Mark)**

Which of the following is the graph of $y = \sin x$ ?

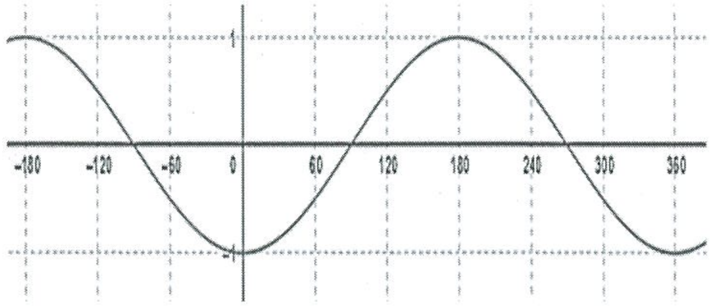
(A)



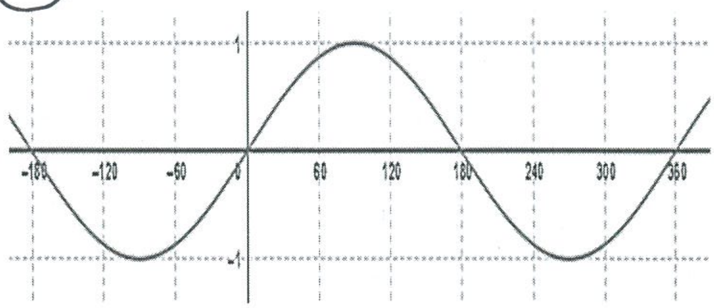

(B)




(C)

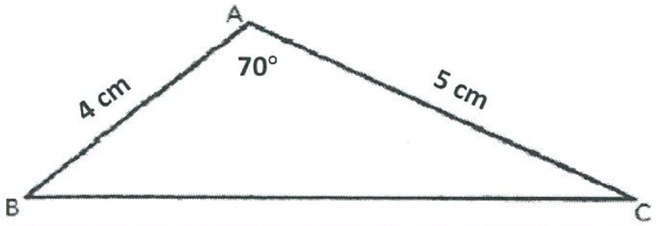



(D)



**Question 6**

Consider the following $\Delta ABC$.




**(a)** Find the length of side $BC$, correct to two decimal places **(2 Marks)**

$BC = \sqrt{4^2+5^2-2(4)(5)\cos 70}$ 1

$= 5.23$ cm 1 units not necessary

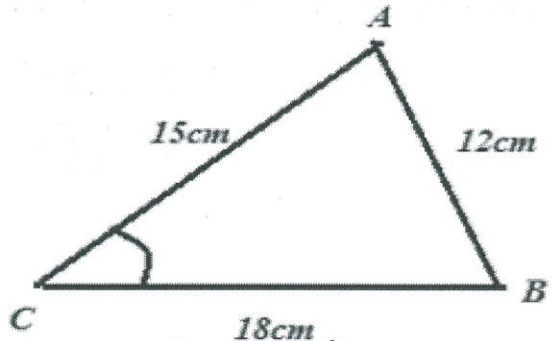
**(b)** Find the area of $\Delta ABC$, correct to two decimal places. **(2 Marks)**

$\text{Area} = \frac{1}{2} \times 4 \times 5 \times \sin 70$ 1

$= 9.40 \text{ cm}^2$ 1 correct rounding

**Question 7** **(2 Marks)**

Find the size of angle $C$, to the nearest minute.




$\cos C = \frac{15^2+18^2-12^2}{2(15)(18)}$ 1

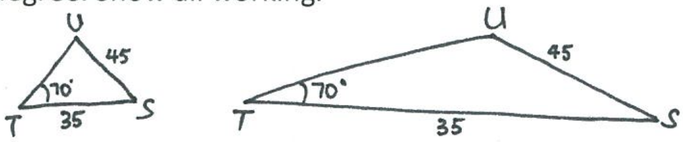
$\cos C = 0.75$

$C = \cos^{-1}(0.75)$

$C = 41°25'$ 1

**Question 8** **(3 Marks)**

In $\Delta STU$, $ST = 35cm$, $SU = 45cm$ and $\angle T = 70°$. Find all possible values for $\angle U$, correct to the nearest degree. Show all working.




$\frac{\sin U}{35} = \frac{\sin 70}{45}$

$U = \sin^{-1}\left(\frac{35\sin 70}{45}\right)$

$U = 47°$ and $180-47°$

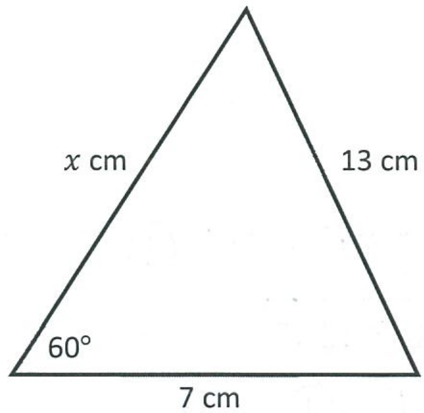
$U = 47°$ 1 and $133°$ 1

but $70° + 133° = 203° > 180°$ 1 $\therefore U \neq 133°$

$\therefore U = 47°$

***Question 9** **(2 Marks)**

For the triangle below, show that $x^2 - 7x = 120$.




$13^2 = x^2 + 7^2 - 2(x)(7)\cos 60$ 1

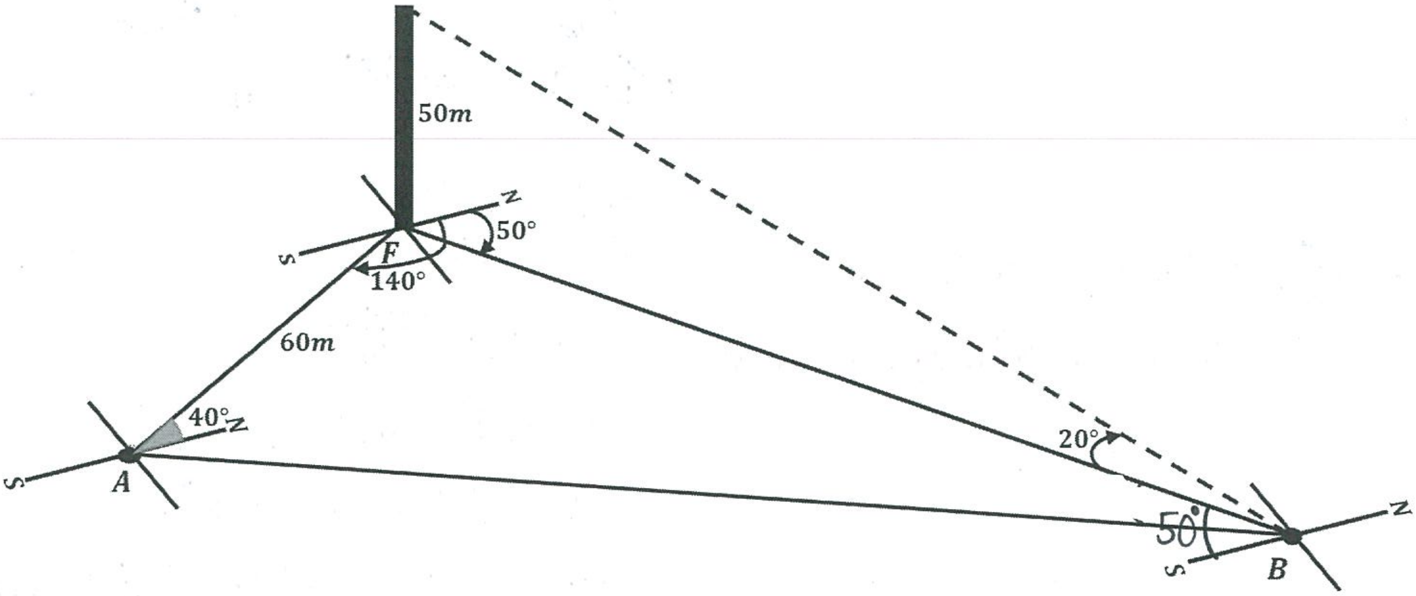
$169 = x^2 + 49 - 14x\cos 60$

$120 = x^2 - 14x\left(\frac{1}{2}\right)$ 1

$120 = x^2 - 7x$

**Question 10**

A flagpole ($F$) stands $50m$ tall. From the flagpole, point $A$ is on a bearing of $140°$ and is $60m$ away. Point $B$ is on a bearing of $50°$ from the same flagpole. The angle of elevation from point $B$ to the top of the flagpole is $20°$. An angle of $40°$ has been marked on the diagram.




**(a)** How far, to the nearest metre, is point $B$ from the flagpole? **(1 Mark)**

$\tan 20 = \frac{50}{FB}$

$FB = 137\text{ m}$ 1

**(b)** Find the size of $\angle AFB$. Hence, find the distance between $A$ and $B$, to the nearest metre. **(2 Marks)**

$\angle AFB = 140° - 50° = 90°$ 1

$\therefore AB = \sqrt{60^2 + 137^2}$

$= 150\text{m}$ 1

**(c)** What is the bearing of point $A$ from point $B$, to the nearest degree? **(2 Marks)**

$\tan \angle FBA = \frac{60}{137}$

$\angle FBA = 23.65°$

$\angle ABS = 50 - 23.65 = 26.35°$ 1

$\therefore$ Bearing of A from B $= 180 + 26.35°$

$= 206.35°$

$= 206°$ 1

## Section 2: Solving Inequalities and Regions

**Question 1** **(1 Mark)**

Write the following statement as an inequality, using the pronumeral given.

Only people aged $(A)$ 18 to 70 years can donate blood.

$18 \leq A \leq 70$ 1

(or $A \geq 18$ and $A \leq 70$)

**Question 2**

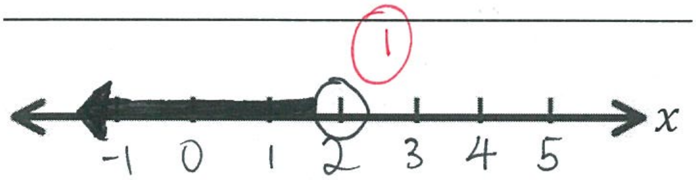
Solve the following inequalities and graph the solution on a number line.

**(a)** $16 > 4(2 + x)$ **(2 Marks)**

$4 > 2 + x$

$2 > x$ 1

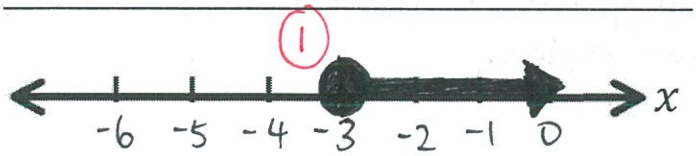
$x < 2$




**(b)** $11 - 3x \leq 20$ **(2 Marks)**

$-3x \leq 9$

$x \geq -3$ 1

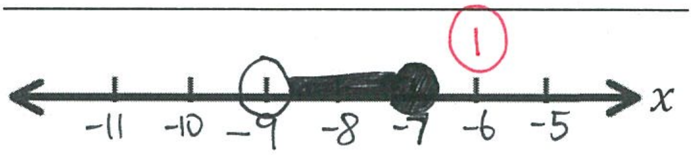



**Question 2 continued**

**(c)** $6 \leq -2(x + 4) < 10$ **(2 Marks)**

$-3 \geq x + 4 > -5$

$-7 \geq x > -9$ 1




**Question 3** **(2 Marks)**

Solve: $\frac{5+3k}{4} < \frac{k}{2}$

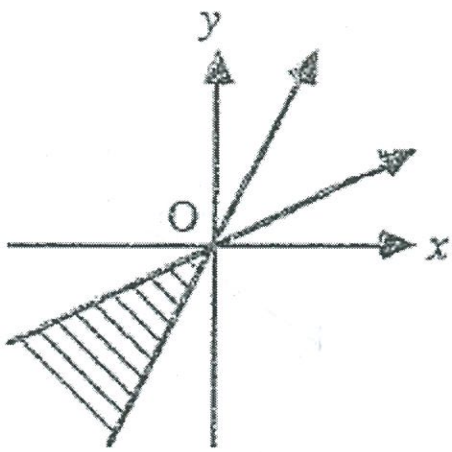
$10 + 6k < 4k$ 1

$2k < -10$

$k < -5$ 1

**Question 4** **(1 Mark)**

Which pair of inequalities could represent the shaded region?




(A) $y \leq \frac{1}{3}x$ , $y \leq 3x$

(B) $y \leq \frac{1}{3}x$ , $y \geq 3x$

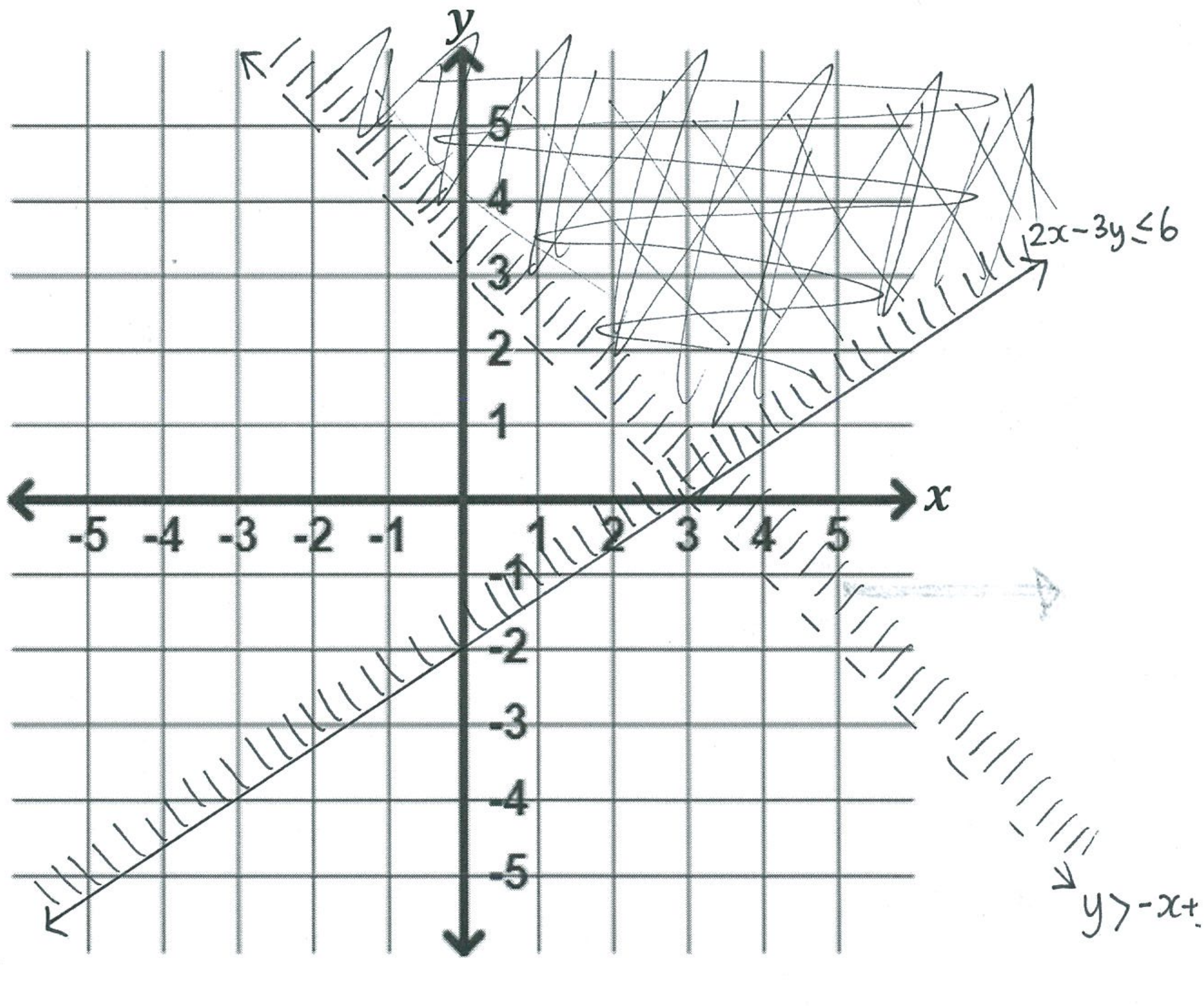
(C) $y \geq \frac{1}{3}x$ , $y \leq 3x$

(D) $y \geq \frac{1}{3}x$ , $y \geq 3x$

**Question 5** **(3 Marks)**

Graph the following linear inequalities on the number plane provided, and shade the region that satisfies both the inequalities. Use the lines provided for any working.

$y > -x + 3$ $2x - 3y \leq 6$

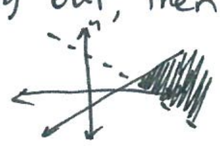



1 mark for each inequality correctly graphed (solid/broken line), labelled, and shaded region.

① for correct intersecting region

*If incorrect intersecting region is shaded without any other shading for working out, then only 1 mark.

eg.



## Section 3: Coordinate Geometry

**Question 1**

Line $\ell$ has the equation $y = \frac{7-4x}{2}$.

**(a)** Find the gradient and $y$-intercept of line $\ell$. **(2 Marks)**

gradient $= -2$

y intercept $= 7/2$

**(b)** Find the equation, in gradient-intercept form, of the line that is parallel to line $\ell$ and passes through $(-7,3)$. **(2 Marks)**

$y - 3 = -2(x+7)$ (1)

$y - 3 = -2x - 14$

$y = -2x - 11$ (1)

**Question 2**

Let $A$ and $B$ be the points $(-4,7)$ and $(-2,1)$ respectively.

**(a)** Find the length of interval $AB$, in simplest surd form. **(2 Marks)**

$d = \sqrt{(-4+2)^2 + (7-1)^2}$

$= \sqrt{40}$ (1)

$= 2\sqrt{10}$ (1)

**Question 2 continued**

**(b)** Find the midpoint of interval $AB$. **(1 Mark)**

$M = \left(\frac{-4-2}{2}, \frac{7+1}{2}\right)$

$= (-3, 4)$ (1)

**(c)** The $y$-intercept of the line that passes through $A$ and $B$ is $-5$. Find the equation, in general form, of the line that passes through $A$ and $B$. **(2 Marks)**

$m = \frac{7-1}{-4+2} = \frac{6}{-2} = -3$ (1)

$y = -3x - 5$

$3x + y + 5 = 0$ (1)

**(d)** The point $C$ has coordinates $(20, -50)$. Are the points $A, B$ and $C$ collinear? Justify your answer with working. **(2 Marks)**

$3(20) - 50 + 5 = 60 - 50 + 5$

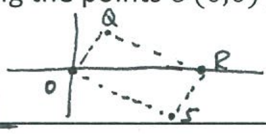
$= 15$ (1)

$\neq 0$

$\therefore$ A, B and C are not collinear. (1)

***Question 3** **(3 marks)**

Which quadrilateral is formed by joining the points $O(0,0)$, $Q(1,2)$, $R(5,0)$ and $S(4,-2)$? Show all working.




① Correct calculations (m)

| | distance | gradient |
|---|---|---|
| OQ | $\sqrt{2^2+1^2}=\sqrt{5}$ | $\frac{2}{1}=2$ |
| QR | $\sqrt{4^2+2^2}=\sqrt{20}$ | $\frac{-2}{4}=-\frac{1}{2}$ |
| RS | $\sqrt{1^2+2^2}=\sqrt{5}$ | $\frac{2}{1}=2$ |
| OS | $\sqrt{4^2+2^2}=\sqrt{20}$ | $\frac{-2}{4}=-\frac{1}{2}$ |

① correct properties

$OQ=RS$ and $QR=OS$ opposite sides are equal

$OQ\neq OS$ and $QR\neq RS$ adjacent sides are unequal

$m_{OQ}=m_{RS}$ and $m_{QR}=m_{OS}$ opposite sides are parallel.

$m_{OQ}\times m_{OS}=-1$ $m_{OS}\times m_{RS}=-1$
$m_{rs}\times m_{QR}=-1$ $m_{QR}\times m_{OQ}=-1$ $\Big\}$ adjacent sides are perpendicular

$\therefore$ OQRS is a rectangle ① Correct conclusion

must show working

Alternatively: Show that diagonals:
- are equal
- bisect each other, but not a right angles

***Question 4**

**(a)** Prove that the points $(-1,2\sqrt{2})$ and $(\sqrt{3},\sqrt{6})$ both lie on the same circle whose centre is at the origin. **(2 marks)**

$$d_1=\sqrt{(-1-0)^2+(2\sqrt{2}-0)^2} \qquad d_2=\sqrt{(\sqrt{3}-0)^2+(\sqrt{6}-0)^2}$$
$$=\sqrt{1+8} \qquad =\sqrt{3+6}$$
$$=\sqrt{9} \qquad =\sqrt{9}$$
$$=3 \qquad =3$$

①

① $(-1,2\sqrt{2})$ and $(\sqrt{3},\sqrt{6})$ are the same distance from $(0,0)$, so they lie on the same circle.

**(b)** Define the region which is inside and including the circle. **(1 mark)**

$x^2+y^2\leq 9$ ①

**End of Exam**