

## A61 (H) Equations of Tangents to a Circle

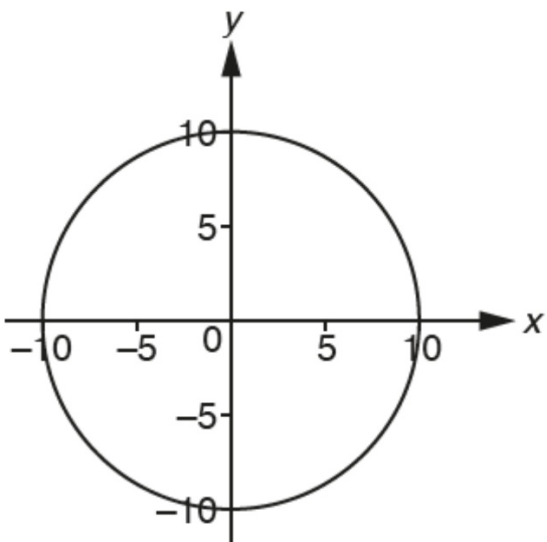
OCR

17 The diagram shows a circle, centre the origin.

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(b) Point P has coordinates  $(8, -6)$ .  
Show that point P lies on the circle.

(c) Find the equation of the tangent to the circle at point P.



(c) ..... [5]

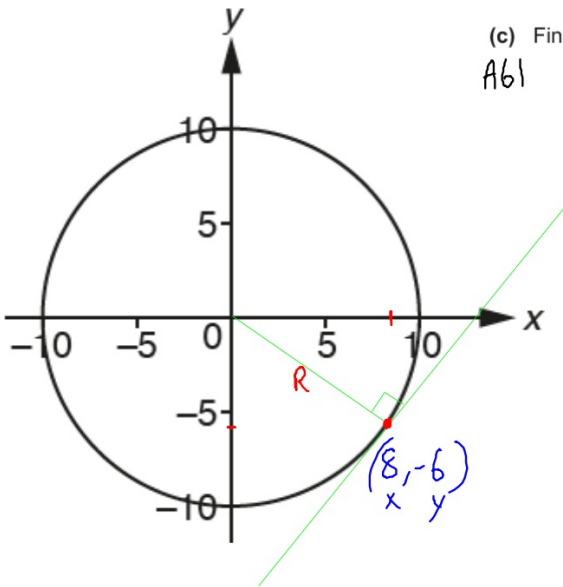
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(b) Point P has coordinates (8, -6).  
Show that point P lies on the circle.

(c) Find the equation of the tangent to the circle at point P.

AB1



$$\text{Gradient of Radius} = -\frac{y}{x} = -\frac{6}{8}$$

$$= -\frac{3}{4}$$

$$\text{Gradient of tangent} = +\frac{4}{3}$$

Tangent

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

ans

$$y = \frac{4}{3}x - 16\frac{2}{3} \checkmark$$

$$-6 = \frac{32}{3}x$$

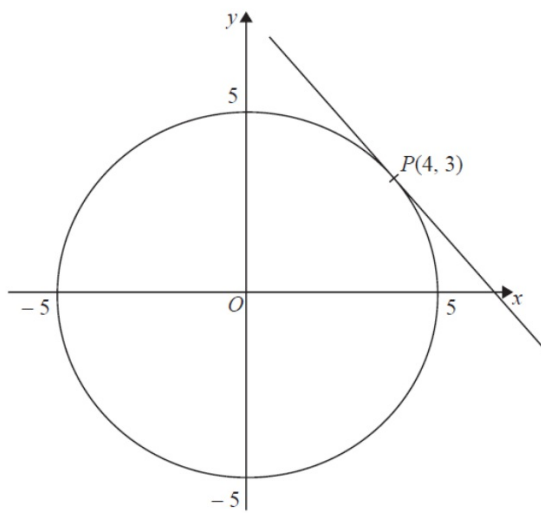
$$\underline{-6 = 10\frac{2}{3} - 16\frac{2}{3}}$$

(c) ..... [5]

EDEXCEL

23 Here is a circle, centre  $O$ , and the tangent to the circle at the point  $P(4, 3)$  on the circle.

Video created by W Neill

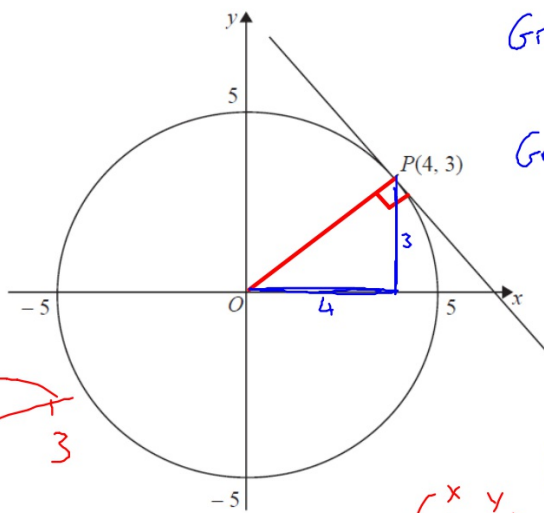


Find an equation of the tangent at the point  $P$ .

.....  
(Total for Question 23 is 3 marks)

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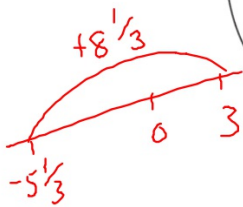


Gradient of  $OP = \frac{3}{4}$

Gradient of perpendicular  
 $= -\frac{4}{3}$

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

$y = -\frac{1}{3}x + 8\frac{1}{3}$  ...ans ✓



Find an equation of the tangent at the point  $P$ .

$(x, y) \rightarrow (4, 3)$   
 $4x - \frac{1}{3}$   
 $4x - 1 = -4$   
 $4x - \frac{1}{3} = -\frac{1}{3}$  }  $-\frac{1}{3}$

$3 = -5\frac{1}{3} + 8\frac{1}{3}$

(Total for Question 23 is 3 marks)

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**22** The line  $l$  is a tangent to the circle  $x^2 + y^2 = 40$  at the point  $A$ .  
 $A$  is the point  $(2, 6)$ .

The line  $l$  crosses the  $x$ -axis at the point  $P$ .

Work out the area of triangle  $OAP$ .

.....  
**(Total for Question 22 is 5 marks)**

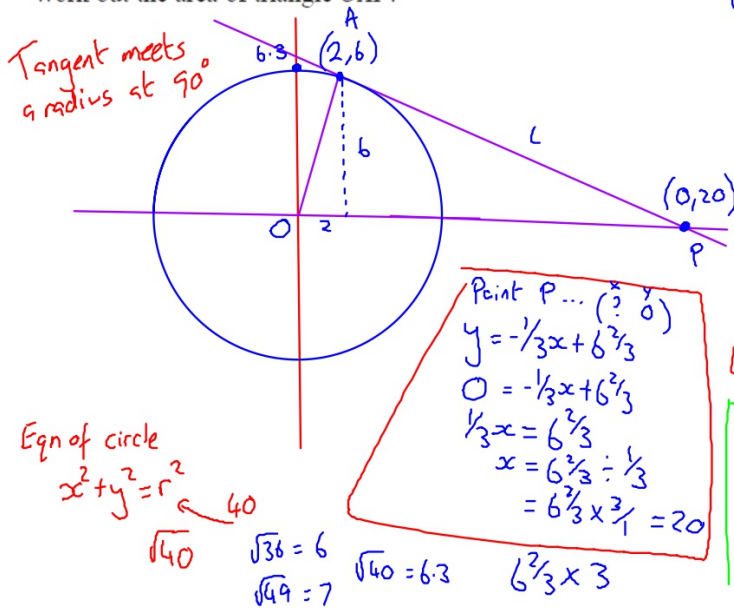


Video created by W Neill

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The line  $l$  crosses the  $x$ -axis at the point  $P$ .

Work out the area of triangle  $OAP$ .



$$\text{Gradient } OA = \frac{3}{1} \quad \frac{y}{x} = \frac{6}{2} = 3$$

$$\text{Gradient of } L = \text{Neg Rec} = -\frac{1}{3}$$

$$L \dots y = mx + c$$

$$y = -\frac{1}{3}x + 6\frac{2}{3}$$

Sub in  $(2, 6)$  ...  $6 = -\frac{2}{3} + 6\frac{2}{3}$

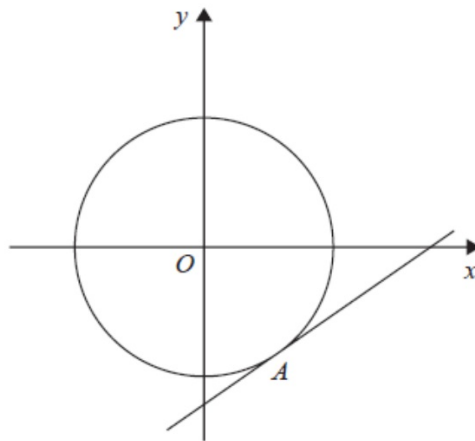
$$L \dots y = -\frac{1}{3}x + 6\frac{2}{3}$$

$$\text{Area of } \triangle = \frac{B \times H}{2} = \frac{20 \times 6}{2} = 60 \text{ units}^2$$

(Total for Question 22 is 5 marks)

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22 The diagram shows the circle with equation  $x^2 + y^2 = 261$



A tangent to the circle is drawn at point  $A$  with coordinates  $(p, -15)$ , where  $p > 0$

Find an equation of the tangent at  $A$ .

.....  
(Total for Question 22 is 5 marks)

22 The diagram shows the circle with equation  $x^2 + y^2 = 261$

by W Neill

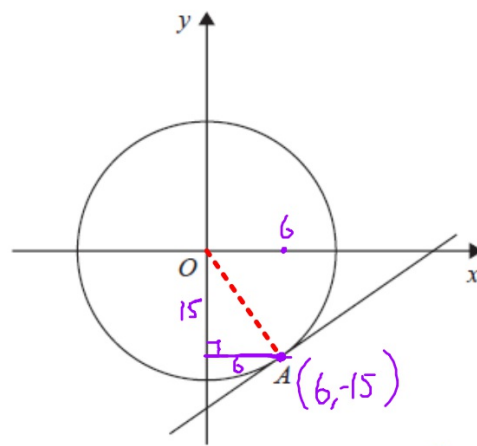
$$x^2 + y^2 = 261$$

$$x^2 + 225 = 261$$

$$x^2 = 36$$

$$x = 6$$

$$(15)^2 = 225$$



Gradient of Radius

$$\frac{v}{h} = -\frac{15}{6}$$

Tangent meets radius at  $90^\circ$

Gradient of tangent  
 → neg reciprocal

A tangent to the circle is drawn at point  $A$  with coordinates  $(p, -15)$ , where  $p > 0$ .  $-\frac{15}{6} \rightarrow \frac{6}{15}$

Find an equation of the tangent at  $A$ .

Equation of tangent  $\rightarrow y = \frac{6}{15}x - 17.4$

$y = \frac{6}{15}x$   
 $-15 = 2.4(-17.4)$

$$y = \frac{6}{15}x - 17.4$$

(Total for Question 22 is 5 marks)

**23** **L** is the circle with equation  $x^2 + y^2 = 4$

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$P\left(\frac{3}{2}, \frac{\sqrt{7}}{2}\right)$  is a point on **L**.

Find an equation of the tangent to **L** at the point *P*.

.....  
(Total for Question 23 is 3 marks)

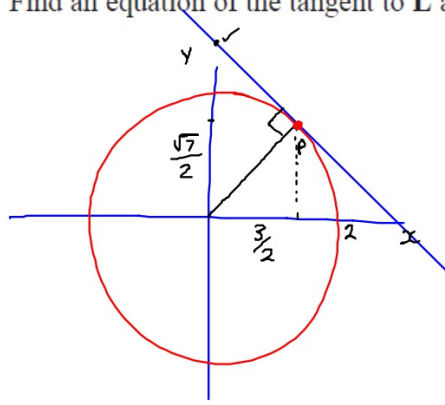
23 L is the circle with equation  $x^2 + y^2 = 4$

$x^2 + y^2 = r^2$   
 $r^2 = 4$   
 $r = \sqrt{4}$   
 $r = 2$

Video created by W Neill

$P\left(\frac{3}{2}, \frac{\sqrt{7}}{2}\right)$  is a point on L.

Find an equation of the tangent to L at the point P.



Gradient of Radius

$$\begin{aligned} \frac{v}{h} &= \frac{\sqrt{7}}{2} \div \frac{3}{2} \\ &= \frac{\sqrt{7}}{2} \times \frac{2}{3} \\ &= \frac{\sqrt{7}}{3} \end{aligned}$$

Gradient of Tangent

$\frac{\sqrt{7}}{3}$   $\xrightarrow{-rec}$   $-\frac{3}{\sqrt{7}}$

$$y = -\frac{3}{\sqrt{7}}x$$

$$\frac{\sqrt{7}}{2} = -\frac{3}{\sqrt{7}} \times \frac{3}{2}$$

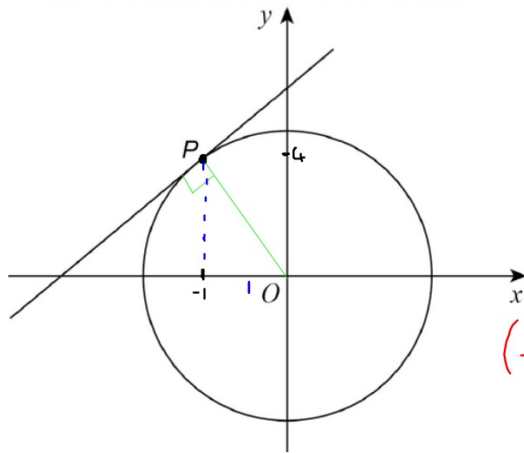
AQA

27

$P(-1, 4)$  is a point on a circle, centre  $O$

Video created by W Neill

A61



Not drawn accurately

$$\begin{aligned} \text{Gradient radius} &= \frac{y}{x} \\ &= \frac{4}{-1} = -4 \end{aligned}$$

Gradient of tangent (neg recip)

$(x, y)$   
 $(-1, 4)$

$$\begin{aligned} y &= \frac{1}{4}x \\ 4 &= \frac{1}{4}(-1) \\ 4 &= -\frac{1}{4} + 4\frac{1}{4} \end{aligned}$$

[4 marks]

Work out the equation of the tangent to the circle at  $P$ .

Give your answer in the form  $y = mx + c$

Answer

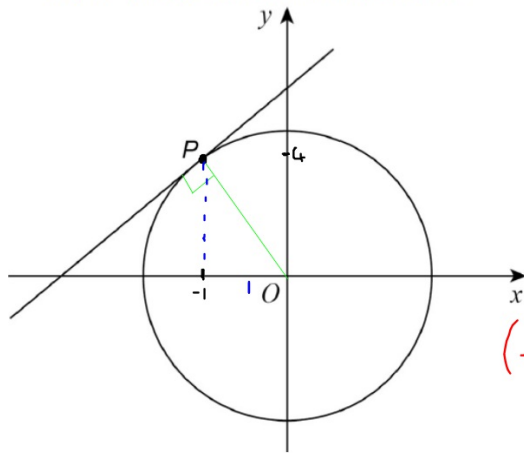
$$y = \frac{1}{4}x + 4\frac{1}{4} \checkmark$$

27

 $P(-1, 4)$  is a point on a circle, centre  $O$ 

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Gradient of tangent (neg recip)

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**[4 marks]**Work out the equation of the tangent to the circle at  $P$ .Give your answer in the form  $y = mx + c$ 

Answer

$$y = \frac{1}{4}x + 4\frac{1}{4} \checkmark$$



28  $P$  is a point on the circle with equation  $x^2 + y^2 = 80$

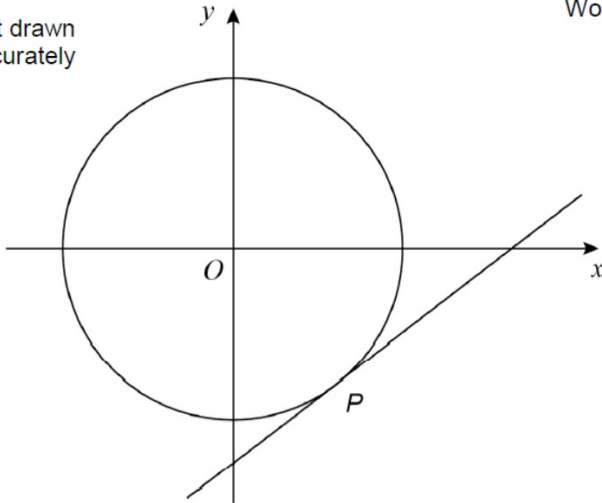
Video created by W Neill

A61  $P$  has  $x$ -coordinate 4 and is below the  $x$ -axis.

Work out the equation of the tangent to the circle at  $P$ .

[5 marks]

Not drawn accurately



Answer \_\_\_\_\_

28

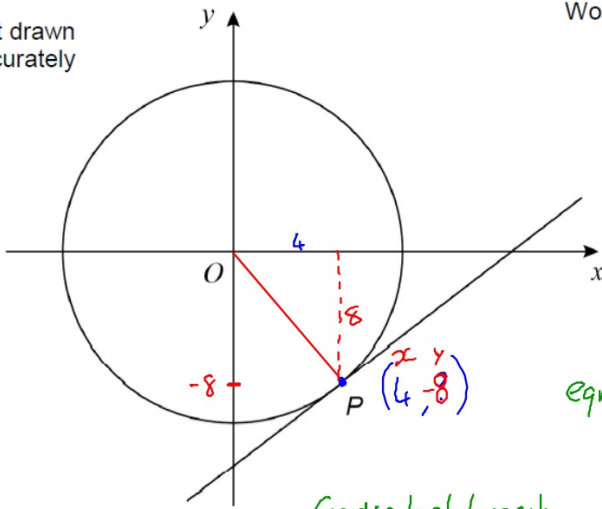
$P$  is a point on the circle with equation  $x^2 + y^2 = 80$

Video created by W Neill

A61

$P$  has  $x$ -coordinate 4 and is below the  $x$ -axis.

Not drawn accurately



Work out the equation of the tangent to the circle at  $P$ .

[5 marks]

$$x^2 + y^2 = 80$$

$$4^2 + y^2 = 80 \Rightarrow 16 + y^2 = 80$$

$$y^2 = 64$$

$$y = 8$$

Gradient of Radius

$$\frac{y}{x} = \frac{-8}{4} = -2$$

eqn of tangent ...  $y = mx + c$

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

$$-8 = \frac{1}{2}(4)$$

$$-8 = 2 - 10$$

$x$   $y$   
 $(4, -8)$

Gradient of tangent

neg reciprocal of radius  $-2 \dots +\frac{1}{2}$

Answer

$$y = \frac{1}{2}x - 10 \checkmark$$