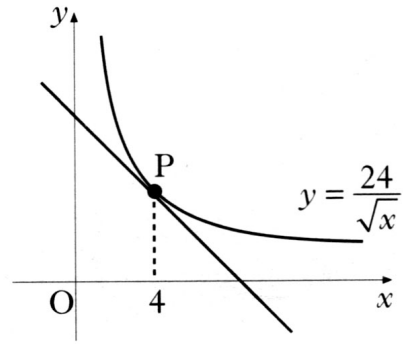


**Banker Question: No. 3**

The diagram shows the graph of  $y = \frac{24}{\sqrt{x}}$ ,  $x > 0$

Find the equation of the tangent at P,  
where  $x = 4$ .

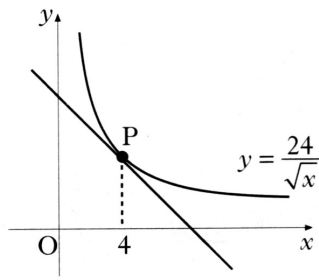


(6)

[Scroll to next page to see solution]

### Banker Question: No. 3

#### Solution.



$$y = \frac{24}{\sqrt{x}}$$

Put into straight line form  $y = 24x^{-\frac{1}{2}}$

Differentiate  $\frac{dy}{dx} = -\frac{1}{2} \times 24x^{-\frac{3}{2}}$

Simplify  $\frac{dy}{dx} = -12x^{-\frac{3}{2}}$

$$\Rightarrow \frac{dy}{dx} = -12 \times \frac{1}{(\sqrt{x})^3}$$

Find gradient when  $x = 4$

$$\Rightarrow \frac{dy}{dx} = -12 \times \frac{1}{(\sqrt{4})^3}$$

$$\Rightarrow \frac{dy}{dx} = -12 \times \frac{1}{(2)^3}$$

$$\Rightarrow -\frac{12}{8} \Rightarrow -\frac{3}{2}$$

Find y-coordinate:

$$y = \frac{24}{\sqrt{x}} \Rightarrow y = \frac{24}{\sqrt{4}} \Rightarrow y = 12$$

gradient is:  $-\frac{3}{2}$  point is (4, 12)

Equation is:

$$y - 12 = -\frac{3}{2}(x - 4) \Rightarrow 2y - 24 = -3x + 12$$

$$\Rightarrow 2y + 3x = 36$$

#### Notes on solution

By looking at the question you should know immediately it is about the differentiation and the equation of a tangent.

On further reading you should recognise the words: 'equation of tangent, 'at  $x = 4$ ',

You **MUST** put the equation into straight line form before you can differentiate it.

e.g.  $\sqrt{x} = x^{\frac{1}{2}}$   $\frac{1}{\sqrt{x}} = x^{-\frac{1}{2}}$   $\frac{1}{\sqrt{x^3}} = x^{-\frac{3}{2}}$

Differentiate to obtain the gradient of the tangent at any point on the curve

**Rule:** Bring the power down to the front. **DECREASE** the power by 1

If you are going to evaluate the derivative put it back into root form.

Evaluate the gradient function  $\frac{dy}{dx}$  at the point  $x = 4$  to find the gradient of the tangent where  $x = 4$ .

Use brackets to make sure you evaluate it properly.

To find the equation of a tangent – you need a point and the gradient.

You have the gradient ( $\frac{dy}{dx}$  when  $x = 4$ )

You now need a point. So find the y-coordinate when  $x = 4$ .

Put  $x = 4$  into the original equation.

Use the formula:  $y - b = m(x - a)$  to find the equation of a line with gradient  $m$  through point  $(a, b)$