

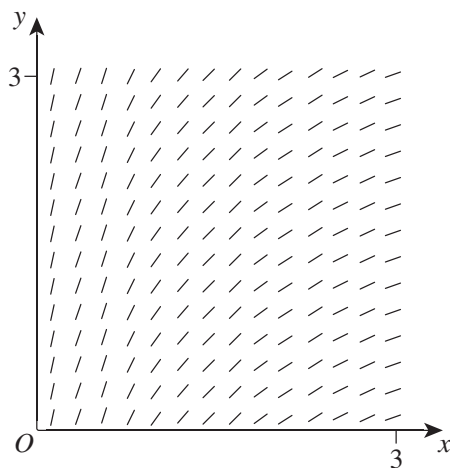
SECTION 1**QUESTION 1**

Which of the following is an antiderivative of $\frac{\sin(x)}{\cos^3(x)}$?

- (A) $\frac{1}{2}\sec^2(x)$
- (B) $-\frac{1}{2}\sec^2(x)$
- (C) $-\frac{1}{4}\sec^4(x)$
- (D) $\frac{1}{4}\sec^4(x)$

QUESTION 2

The diagram below shows a slope field.



The equation whose derivative could be represented by the slope field could be

- (A) $y = e^x$
- (B) $y = e^{-x}$
- (C) $y = \cos(x)$
- (D) $y = \ln(x)$

QCE Specialist Mathematics Units 3&4

Paper 1 – Technology-free

SECTION 1 – MULTIPLE-CHOICE QUESTIONS

	A	B	C	D
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QUESTION 6 A

$$f(x) = \tan^{-1}(x)$$

$$f'(x) = \frac{1}{x^2 + 1}$$

$$f''(x) = -\frac{2x}{(x^2 + 1)^2}$$

$$f'(x) = f''(x)$$

$$1 = -\frac{2x}{x^2 + 1}$$

$$x^2 + 2x + 1 = 0$$

$$(x + 1)^2 = 0$$

$$x = -1$$

QUESTION 7 D

$$\begin{aligned} a + \lambda(b - a) &= 2i - 3j + 3k + \lambda((-3 - 2)i + (1 - -3)j + (-1 - 3)k) \\ &= 2i - 3j + 3k + \lambda(-5i + 4j - 4k) \end{aligned}$$

QUESTION 8 C

$$\tan \theta = \frac{h}{40}$$

$$h = 40 \tan \theta$$

$$\begin{aligned} \frac{dh}{dt} &= \frac{dh}{d\theta} \times \frac{d\theta}{dt} \\ &= 40 \sec^2 \theta \times \frac{d\theta}{dt} \end{aligned}$$

$$\begin{aligned} \frac{d\theta}{dt} &= \frac{1}{4 \sec^2 \theta} \\ &= \frac{1}{4} \cos^2 \theta \end{aligned}$$

When $h = 30$, $\tan \theta = \frac{3}{4}$, so $\cos \theta = \frac{4}{5}$.

$$\begin{aligned} \frac{d\theta}{dt} &= \frac{1}{4} \left(\frac{4}{5} \right)^2 \\ &= \frac{4}{25} \end{aligned}$$