

Foundation Year Further Maths Exam
2015/2016

Q1)

(i) $\frac{dy}{dx} = 15x^2 - 4x + 1$

1 1 1
(3)

(ii) $y = x^2 + 7x + 12$

$$\frac{dy}{dx} = 2x + 7$$

1
1 1
(3)

(iii) $\frac{dy}{dx} = 6 \cos 3x + 3e^{3x} - \frac{1}{x}$

1 1 1
(3)

(iv) $y = 2x^{-3}$

$$\frac{dy}{dx} = -6x^{-4} \quad \left(\text{or } -\frac{6}{x^4}\right)$$

1
1
(2)

(v) $y = x(x^{0.5})$

$$y = x^{1.5}$$

$$\frac{dy}{dx} = 1.5x^{0.5} \quad \left(\text{or } \frac{3}{2}x^{1/2}\right)$$

1
1
(2)

$$(vi) \quad y = x^3 \cos 4x$$

$\uparrow$ $\uparrow$
 u v

$$\frac{du}{dx} = 3x^2 \quad \frac{dv}{dx} = -4 \sin 4x$$

$$\therefore \frac{dy}{dx} = (\cos 4x)(3x^2) + (x^3)(-4 \sin 4x) \quad |||| \quad (4)$$

$$\text{i.e.} = 3x^2 \cos 4x - 4x^3 \sin 4x$$

$$(vii) \quad y = \frac{e^{5x}}{\tan 2x}$$

$\leftarrow u$
 $\leftarrow v$

$$\frac{du}{dx} = 5e^{5x} \quad \frac{dv}{dx} = 2 \sec^2 2x$$

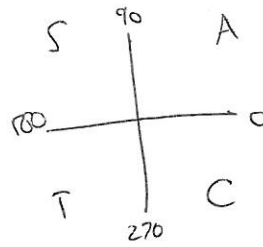
$$\therefore \frac{dy}{dx} = \frac{(\tan 2x)(5e^{5x}) - (e^{5x})(2 \sec^2 2x)}{(\tan 2x)^2} \quad |||| \quad (5)$$

Q2)

$$\sin x = 0.23$$

(i)

$$\begin{aligned} x &= 13.30^\circ \\ x &= 166.70^\circ \end{aligned}$$



②

(ii) $\cos x = 0.46$

$$\begin{aligned} x &= 62.61^\circ \\ x &= 297.39^\circ \end{aligned}$$

②

(iii) $5 \sin x = 4$
 $\therefore \sin x = 4/5$

$$\begin{aligned} x &= 53.13^\circ \\ x &= 126.87^\circ \end{aligned}$$

③

(iv) $6 \tan x = -7$

$$\tan x = -7/6$$

$$x = \tan^{-1}(7/6)$$

$$x = 49.40^\circ \leftarrow \text{plot where tan is -ve}$$

$$\begin{aligned} x &= 130.60^\circ \\ x &= 310.60^\circ \end{aligned}$$

④

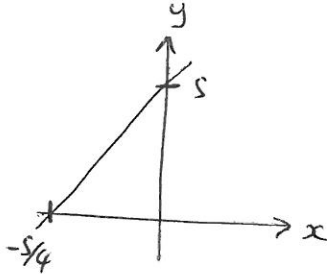
Q3)

(-1 if axes not labelled)

(i) $y = 4x + 5$

$0 = 4x + 5$

$-\frac{5}{4} = x$

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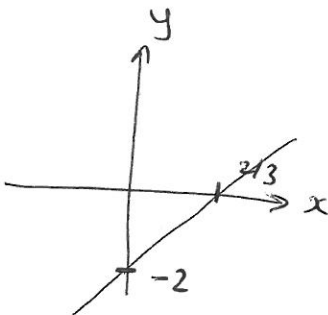
(3)

(ii) $y - 3x + 2 = 0$

$y = 3x - 2$

$0 = 3x - 2$

$\frac{2}{3} = x$



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(4)

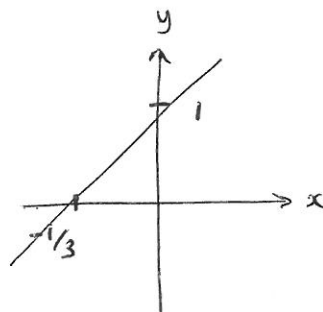
(iii) $5y - 15x = 5$

$\div 5$ $5y = 15x + 5$

$y = 3x + 1$

$0 = 3x + 1$

$-\frac{1}{3} = x$

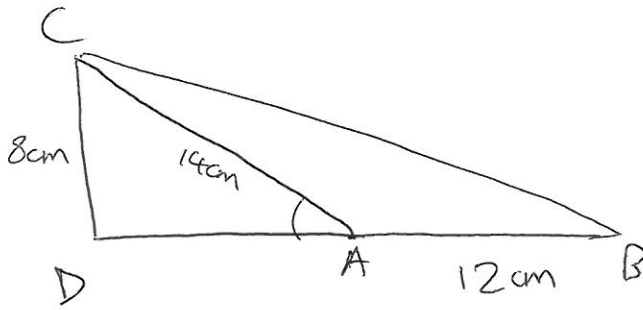
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(5)

Q3 Total

(12)

Q4)



$$(i) \sin \widehat{CAD} = \frac{8}{14}$$

$$\widehat{CAD} = \sin^{-1}(8/14)$$

$$\widehat{CAD} = 34.85^\circ$$

②

$$(ii) \widehat{BAC} = 180^\circ - 34.85^\circ$$

$$= 145.15^\circ$$

①

(iii) using Cosine Rule

$$(BC)^2 = (14)^2 + (12)^2 - 2(14)(12) \cos(145.15^\circ)$$

$$(BC)^2 = 196 + 144 - 336(-0.82)$$

$$(BC)^2 = 196 + 144 + 275.52$$

$$(BC)^2 = 615.52$$

$$BC = \sqrt{615.52}$$

$$BC = 24.81 \text{ cm}$$

⑥

Q4 TOTAL

⑨

Q5)

$$(i) = \frac{x^5}{5} + \frac{3x^3}{3} - \frac{2x^2}{2} + 5x + C$$

|||||

⑤

$$(ii) \int x^2 - 4x + 4 \, dx$$

$$= \frac{x^3}{3} - \frac{4x^2}{2} + 4x + C$$

$$\text{i.e.} = \frac{x^3}{3} - 2x^2 + 4x + C$$

|||||

⑤

$$(iii) = \frac{5}{3} \tan 3x + C$$

|||

③

$$(iv) \int x^{-4} + \frac{1}{x} + 1 \, dx$$

$$= \frac{x^{-3}}{-3} + \ln x + x + C$$

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|||||

⑤