

Further Mathematics mock test March 2018

Question 1

Differentiate the following:

a) $y = 5x^3 - 2x + 5$

b) $y = (x + 3)(x + 5)$

c) $y = \sqrt{x} + e^{2x}$

d) $y = 2 \sin 3x$

e) $y = x^2 \tan 2x$

f) $y = \frac{e^{3x}}{5x^2 + 2x - 1}$

g) $y = (4x^3 - 4x - 1)^5$

Question 2

Sketch the following lines, indicating where they cross the 'x' and 'y' axes.

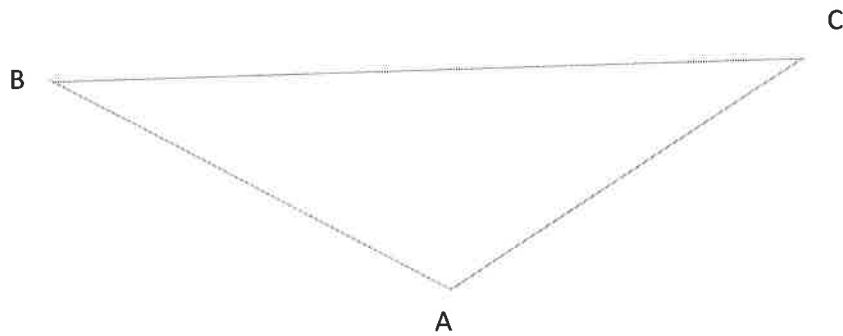
a) $y = 3x + 2$

b) $4y = -8x + 4$

c) $-x = -y + 3$

Question 3

Given the following non-right-angled triangle:



Where angle A is 35 degrees, AB is length 5 metres, AC is length 7 metres.

Find the length of BC.

Question 4

Integrate the following:

a) $\int 4x^4 + 3x^2 - 1 \, dx$

b) $\int (x + 6)^2 \, dx$

c) $\int 3 \cos 2x \, dx$

d) $\int \frac{1}{x^5} \, dx$

e) $\int_0^4 (x + 2)(x + 5) \, dx$

Q1)

a) $y = 5x^3 - 2x + 5$

$$\frac{dy}{dx} = 15x^2 - 2$$

b) $y = (x+3)(x+5)$

$$y = x^2 + 8x + 15$$

$$\frac{dy}{dx} = 2x + 8$$

c) $y = \sqrt{x} + e^{2x}$

$$y = x^{0.5} + e^{2x}$$

$$\frac{dy}{dx} = 0.5x^{-0.5} + 2e^{2x}$$

d) $y = 2\sin 3x$

$$\frac{dy}{dx} = 6\cos 3x$$

e) $y = x^2 \tan 2x$

$$\frac{du}{dx} = 2x$$

$$\frac{dv}{dx} = 2\sec^2 2x$$

Product
Rule
=

$$\frac{dy}{dx} = (\tan 2x)(2x) + (x^2)(2\sec^2 2x)$$

f) $y = \frac{e^{3x}}{5x^2 + 2x - 1}$ $\leftarrow u$ $\leftarrow v$

Quotient Rule

$$\frac{du}{dx} = 3e^{3x} \quad \frac{dv}{dx} = 10x + 2$$

$$\frac{dy}{dx} = \frac{(5x^2 + 2x - 1)(3e^{3x}) - (e^{3x})(10x + 2)}{(5x^2 + 2x - 1)^2}$$

g) $y = (4x^3 - 4x - 1)^5$

Chain Rule

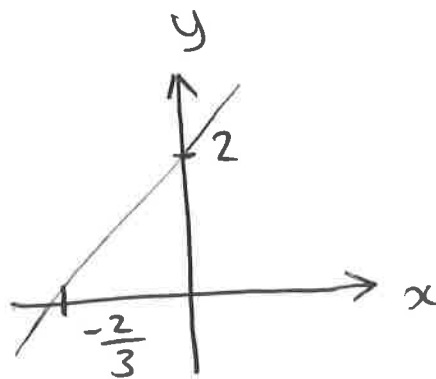
$$\begin{aligned} \frac{dy}{dx} &= 5(4x^3 - 4x - 1)^4 (12x^2 - 4) \\ &= (60x^2 - 20)(4x^3 - 4x - 1)^4 \end{aligned}$$

Q2)

a) $y = 3x + 2$ y intercept
↓

Sub $y=0$ $0 = 3x + 2$

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



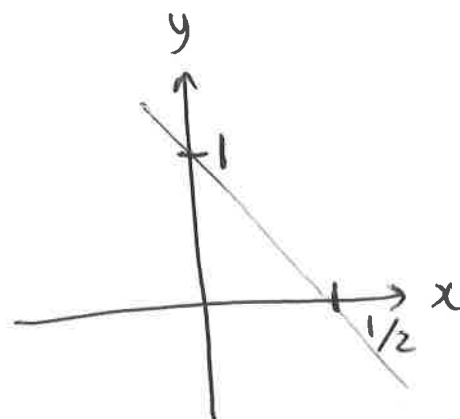
b) $4y = -8x + 4$
 $\div 4$ $y = -2x + 1$

Sub $y=0$

$0 = -2x + 1$

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

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

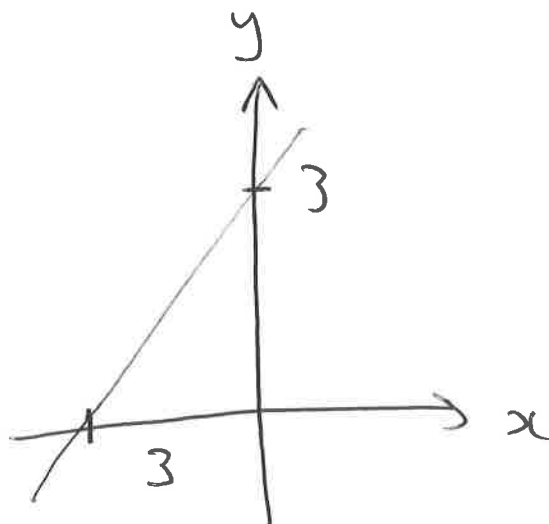


c) $-x = -y + 3$
 get into $y = mx + c$

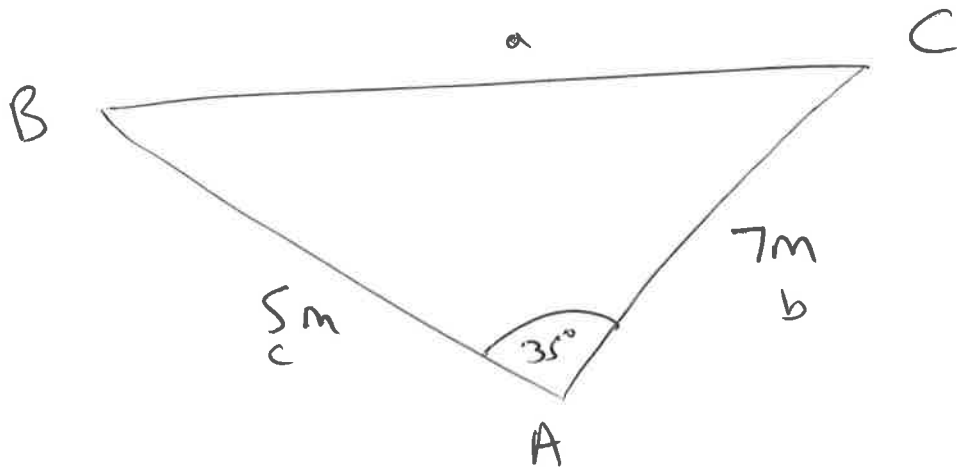
$y = x + 3$

$0 = x + 3$

$-3 = x$



Q3)



Cosine Rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$(BC)^2 = (7)^2 + (5)^2 - 2(5)(7) \cos 35^\circ$$

$$(BC)^2 = 49 + 25 - 57.34$$

$$(BC)^2 = 16.66$$

$$BC = 4.08m$$

Q4)

a) $\int 4x^4 + 3x^2 - 1 \, dx$

$$= \frac{4x^5}{5} + \frac{3x^3}{3} - x + C$$

$$= \frac{4x^5}{5} + x^3 - x + C$$

b) $\int (x+6)^2 \, dx$

$$\int x^2 + 12x + 36 \, dx$$

$$= \frac{x^3}{3} + \frac{12x^2}{2} + 36x + C$$

$$= \frac{x^3}{3} + 6x^2 + 36x + C$$

c) $\int 3\cos 2x \, dx$

$$3 \int \cos 2x \, dx$$

$$= 3 \times \frac{1}{2} \sin 2x + C$$

$$= \frac{3}{2} \sin 2x + C$$

$$d) \int \frac{1}{x^5} dx$$

$$\int x^{-5} dx$$

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

~~not~~

$$= \frac{1}{-4x^4} + C$$

$$e) \int_0^4 (x+2)(x+5) dx$$

$$\int_0^4 x^2 + 7x + 10 dx$$

$$= \left[\frac{x^3}{3} + \frac{7x^2}{2} + 10x \right]_0^4$$

$$= \left[\frac{(4)^3}{3} + \frac{7(4)^2}{2} + 10(4) \right] - [0]$$

$$= [21.33 + 56 + 40] - [0]$$

$$= 117.33$$