Question 1 Start a new booklet ***(6 marks)***

a) Differentiate $y = \dfrac{\cos x}{\cos x + \sin x}$ ***3***

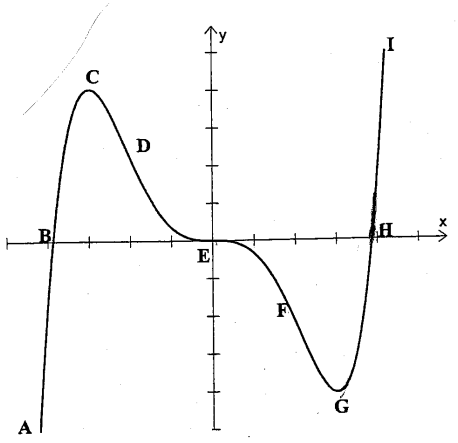
b) Find the integral $\int \dfrac{2 + 3\cos^2 x}{\cos^2 x} dx$ ***2***

c) Evaluate $\lim\limits_{h \to 0} \dfrac{\sin \frac{h}{2}}{h}$ ***1***

Question 2 Start a new booklet ***(8 marks)***

a) For what values of a does $\int_1^a (x-1)dx = \int_0^{\frac{\pi}{4}} \sin 2x dx$? **3**

b) The graph of $y = f(x)$ is shown.



i. Is the function *odd*, *even* or *neither*? **1**

ii. Using the points indicated on the graph, state between which points;

a. $f(x)$ is decreasing and the curve is concave up. **1**

b. $f(x) < 0$ and $f''(x) < 0$ **1**

iii. Detach the sheet at the back of the examination and sketch the graph of $y = f'(x)$ on the axes provided.
Label the corresponding points **A** to **I** on your graph. **2**

Insert your answer sheet inside your question 2 answer booklet.

Question 3 Start a new booklet *(12 marks)*

a) The curve $y = f(x)$ has the gradient function $f'(x) = 3x^2 - 2x - 1$. The y-value of the minimum turning point of the curve is 1. Find the y value of the maximum turning point. **5**

b)

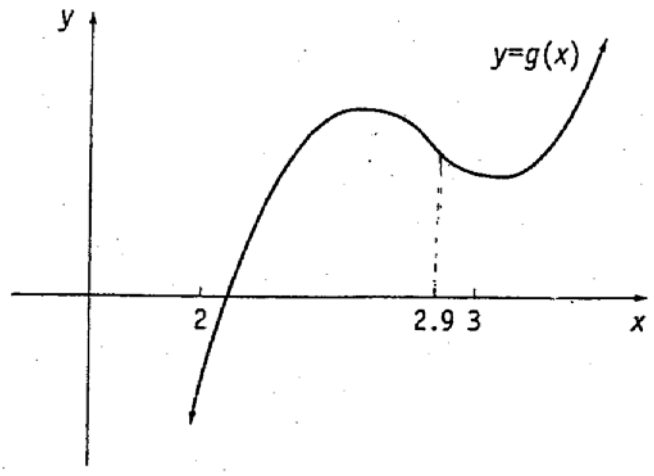
i. Show by substitution, that the curves $y = 1 + \sqrt{x}$ and $y = 7 - x$ meet at the point $(4,3)$. **1**

ii. Sketch, on the same set of axes, the curves $y = 1 + \sqrt{x}$ and $y = 7 - x$ and shade the region bounded by these curves and the y - axis. **2**

iii. Find the volume of the solid formed when the area bounded by curves $y = 1 + \sqrt{x}$ and $y = 7 - x$ and the y-axis is rotated one revolution about the y - axis. **4**

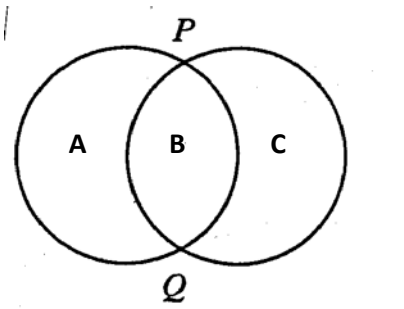
Question 4 (Start a new booklet) *(11 marks)*

a)



The diagram shows the graph of $y = g(x)$ which has a root between $x = 2$ and $x = 3$. Explain why $x_1 = 2.9$ is not a suitable starting value for Newton's method to find this root. **1**

b) Two circles each with a radius 2 cm intersect at P and Q. The common chord PQ subtends an angle θ radians at each centre.



i. Show that the area $A\ cm^2$ of the overlapping part of the circles is given by $A = 4\theta - 4\sin\theta$. **2**

ii. If the three regions A, B and C shown in the diagram all have the same area:

1) show that $\theta - \sin\theta - \frac{\pi}{2} = 0$. **2**

2) Using a starting value of $\theta = 2$, apply Newton's method once to find the value of θ to two decimal places. **3**

c) Evaluate in exact form $\int_0^{\frac{\pi}{2}} \sin^2 3x\ dx$ **3**

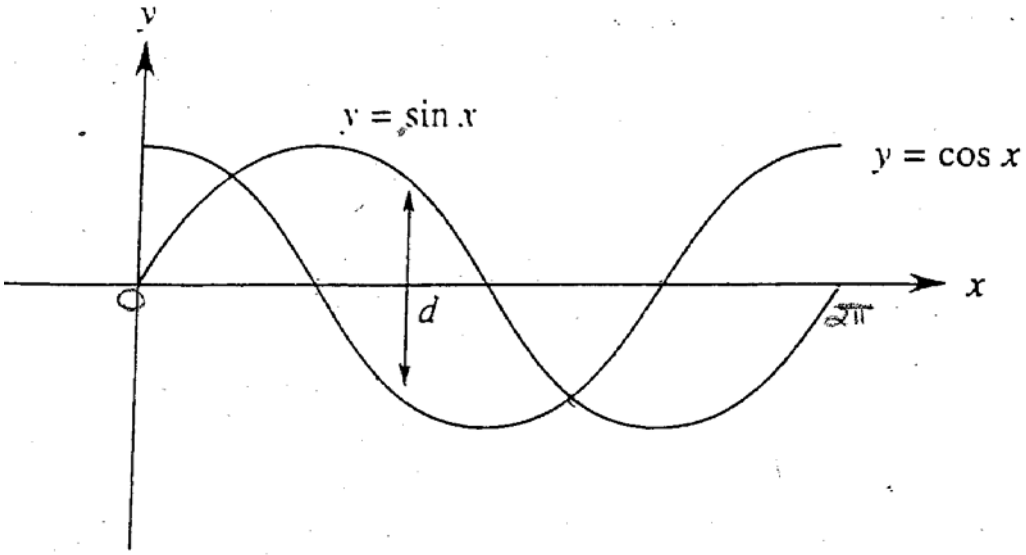
Question 5 (Start a new booklet) ***(10 marks)***

a)

i. Show that $\frac{d}{dx}\left(\tan^3 x\right) = 3\sec^4 x - 3\sec^2 x$ ***2***

ii. Using (i) or otherwise, evaluate. $\int_0^{\frac{\pi}{4}} \sec^4 x \ dx$ ***3***

b)



5

The diagram shows the curves $y = \sin x$ and $y = \cos x$. For a particular x value, the distance ***d*** between the curves has been indicated. Find the maximum distance

between the two curves.

Detach this sheet and insert in your Question2 Booklet.