

Solutions for GCE O Level Additional Math Paper 1 & 2 – 2010

Paper 1:

1. The function f is defined by $f(x) = x^4 - x^3 + kx - 4$ where k is a constant.
 - (i) Given that $x - 2$ is a factor of $f(x)$, find the value of k .
[2]
 - (ii) Using the value of k found in part (i), find the remainder when $f(x)$ is divided by $x + 2$.
[2]

Solution:

- (i) **Method 1: Rewrite**

$$f(x) = x^4 - x^3 + kx - 4 =$$

$$= x^4 - 2x^3 + x^3 - 2x^2 + 2x^2 - 4x + (k + 4)x$$

$$= (x - 2)(x^3 + x^2 + 2x + k + 4) + 2k + 4$$
 Since $x - 2$ is a factor of $f(x) \Rightarrow 2k + 4 = 0 \Leftrightarrow k = -2$
Method 2:
 $\because x - 2$ is a factor of $f(x) \Rightarrow f(2) = 0 \Leftrightarrow 16 - 8 + 2k - 4 = 0$
 $\therefore k = -2$
- (ii) **Method 1: Substitute $k = -2$ and rewrite**

$$f(x) = x^4 - x^3 - 2x - 4 =$$

$$= x^4 + 2x^3 - (3x^3 + 6x^2) + (6x^2 + 12x)$$

$$= (x + 2)(x^3 - 3x^2 + 6x - 14) + 24$$
 Hence, the remainder = 24
Method 2: The remainder = $f(-2) = 24$

2.
 - (i) Show that
 $(\sin x + \cos x)^2 = 1 + \sin 2x$
 [2]
 - (ii) Hence find, in terms of π , the value of
 $\int_0^{\frac{\pi}{2}} (\sin x + \cos x)^2 dx$
 [4]

Solution:

- (i) $(\sin x + \cos x)^2 = \sin^2 x + \cos^2 x + 2 \sin x \cos x = 1 + \sin 2x$
- (ii) Use result from part (i):

$$\int_0^{\frac{\pi}{2}} (\sin x + \cos x)^2 dx = \int_0^{\frac{\pi}{2}} (1 + \sin 2x) dx = \left[x - \frac{\cos 2x}{2} \right]_0^{\frac{\pi}{2}}$$

$$= \left(\frac{\pi}{2} - \frac{\cos \pi}{2} \right) - \left(0 - \frac{\cos 0}{2} \right) = \frac{\pi}{2} + \frac{1}{2} - \left(-\frac{1}{2} \right)$$

$$= \frac{\pi}{2} + 1$$
3. Using a separate diagram for each part, represent on the number line the solution set of
 - (i) $3(2 - x) < x + 18$
[2]
 - (ii) $3(x^2 - 5) > x - 1$
[3]

State the set of values of x which satisfy both of these inequalities.
[1]

Solution: (draw the graph yourself)

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K Morrison



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