α	β	γ	δ	ε	ζ	η	θ	ι	κ	λ	μ	ν	ξ	o	π	ρ	σ	τ	υ	φ	χ	ψ	ω

"A mathematician is a machine for turning coffee into theorems"

P Erdos

Come along to the Maths Association Talk – 29th September at 4:30pm in room 3

Further Maths A2 (M2FP2D1) Assignment α (alpha) A

Test	Application date	Test date	Universities interested	Compulsory?
Test of Mathematics	15/10	9/11	Lancaster Durham	No but may result in reduced offer
MAT	15/10	2/11	Oxford	Yes
MAT	15/10	2/11	Imperial	Expected But if you apply after the 15/10 then you will have to do a STEP paper

DRILL

Drills are the very basic techniques you need to solve maths problems. You need to practise these until you can do them quickly and accurately. Answers are not provided for drill questions.

A. Find:

1) $\frac{1}{2}\int r^2 d\theta$ 2) $\frac{d}{d\theta}(r\sin\theta)$ 3) $\frac{d}{d\theta}(r\cos\theta)$

Given: $r = 3\sin 2\theta$

B. Find:

1) $\frac{1}{2}\int r^2 d\theta$ 2) $\frac{d}{d\theta}(r\sin\theta)$ 3) $\frac{d}{d\theta}(r\cos\theta)$

Given: $r = 4 + \cos 2\theta$

PREPARATION

Every week you will be required to do some preparation for future lessons, to be advised by your teacher.

CURRENT WORK AND CONSOLIDATION

FP2 inequalities

1. Solve each of these inequalities

(a) $\frac{2x-1}{x-2} \geq 0$ (b) $\frac{3x-2}{2-x} > 0$ (c) $\frac{2x^2+x-1}{x^2-1} \leq 0$

(d) $\frac{1-2x}{3-x} > 2$ (e) $\frac{x+a}{x-2} < 0$ (f) $\frac{x}{(x-2)(x+3)} > 0$

(g) $\frac{4x+1}{x} > -4x$ (h) $|2x^2-3x-2| = 3(x+1)$

2. (a) Show that $r = \frac{1}{2}(r(r+1)-r(r-1)$

(b) Hence show that $\sum_{r=1}^{n} r = \frac{n}{2}(n+1)$

3. Given $\frac{1}{r(r+1)(r+2)} \equiv \frac{1}{2r(r+1)} - \frac{1}{2(r+1)(r+2)}$

find $\sum_{r=1}^{n} \frac{1}{r(r+1)(r+2)}$ using the method of differences

4. (a) Express $\frac{1}{r(r+2)}$ in partial fractions

(b) Hence find the sum of the series $\sum_{r=1}^{n} \frac{1}{r(r+2)}$ using the method of differences

5. (a) Express $\frac{1}{(r+2)(r+3)}$ in partial fractions

(b) Hence find the sum of the series $\sum_{r=1}^{n} \frac{1}{(r+2)(r+3)}$ using the method of differences

6. Use the identity $4r^3 \equiv r^2(r+1)^2 - (r-1)^2 r^2$

to find $\sum_{r=1}^{n} r^3$

7. Given that $\frac{r}{(r+1)!} \equiv \frac{1}{r!} - \frac{1}{(r+1)!}$

find $\sum_{r=1}^{n} \frac{r}{(r+1)!}$

8. Given that $\frac{2r+1}{r^2(r+1)^2} \equiv \frac{1}{r^2} - \frac{1}{(r+1)^2}$

find $\sum_{r=1}^{n} \frac{2r+1}{r^2(r+1)^2}$

Solve the following differential equations

9. $$x\frac{dy}{dx} + y = e^x$$

10. $$\frac{x}{y}\frac{dy}{dx} + \ln y = x + 1$$

11. $$e^x y + e^x \frac{dy}{dx} = 2$$

12. $$\frac{dy}{dx} + 3y = e^{-3x}$$

13. $$x^2\frac{dy}{dx} + xy = x + 1$$

14. $$\tan x \frac{dy}{dx} + y = e^x \tan x$$

15. Given that $y = 0$ when $x = \frac{\pi}{2}$, solve

$$x\frac{dy}{dx} = y + x^2(\sin x + x\cos x)$$

16 Find the general solution of the following differential equations:

(a) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} - 4\frac{\mathrm{d}y}{\mathrm{d}x} + 3y = 12$

(b) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + 3\frac{\mathrm{d}y}{\mathrm{d}x} + 2y = 4x$

(c) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} - 2\frac{\mathrm{d}y}{\mathrm{d}x} + y = e^{2x}$

(d) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + 4\frac{\mathrm{d}y}{\mathrm{d}x} + 4y = 2x - 1$

(e) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + y = \cos 2x$

(f) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + 9y = e^{\frac{1}{2}x}$

17. Find the solution subject to the given boundary conditions for each of the following differential equations:

(a) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} - 4\frac{\mathrm{d}y}{\mathrm{d}x} + 3y = 12;\ \frac{\mathrm{d}y}{\mathrm{d}x} = 1$ and $y = 0$ at $x = 0$

(b) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + y = e^x;\ \frac{\mathrm{d}y}{\mathrm{d}x} = y = 0$ at $x = 0$

(c) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} - 2\frac{\mathrm{d}y}{\mathrm{d}x} + y = \cos x;\ \frac{\mathrm{d}y}{\mathrm{d}x} = 0$ and $y = 1$ at $x = 0$

(d) $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 5y = e^{2x}; \frac{dy}{dx} = y = 2\ at\ x = 0$

(e) $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + 2\frac{\mathrm{d}y}{\mathrm{d}x} + 2y = 4x;\ \frac{\mathrm{d}y}{\mathrm{d}x} = y = 0$ at $x = 0$

(f) $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2}+4\dfrac{\mathrm{d}y}{\mathrm{d}x}+4y=2x+4;\ y=1,\ \dfrac{\mathrm{d}y}{\mathrm{d}x}=0$ at $x=0$

Answers:

(1a) $x\le\frac{1}{2}, x>2$ (1b) $\frac{2}{3}<x<2$ (1c) $\frac{1}{2}\le x<1$ (1d) $x>3$

(1e) $-a<x<2$ (1f) $-3<x<0, x>2$ (1g) $x>0$ (1h) $x=\frac{1}{2}\left(3\pm\sqrt{19}\right)$

(2a) Discuss in class (2b) Discuss in class (3) $\dfrac{n(n+3)}{4(n+1)(n+2)}$

(4a) $\dfrac{1}{2r}-\dfrac{1}{(r+2)}$ (4b) $\dfrac{n(3n+5)}{4(n+1)(n+2)}$

(5a) $\dfrac{1}{(r+2)(r+3)}=\dfrac{1}{r+2}-\dfrac{1}{r+3}$ (5b) $\dfrac{n}{3(n+3)}$

(6) $\dfrac{2}{r}+\dfrac{1}{r+1}-\dfrac{3}{r+2}$ (7) Discuss in class (8) $\dfrac{n(n+2)}{(n+1)^2}$

9) $xy=e^x+A$

10) $2x\ln y=x^2+2x+A$

11) $ye^x=2x+A$

12) $ye^{3x}=x+A$

13) $xy=x+\ln Ax$

14) $2y\sin x=e^x(\sin x-\cos x)+A$

15) $y=x(\sin x-\cos x-1)$

16a) $y=Ae^x+Be^{3x}+4$

(16b) $y=Ae^{-x}+Be^{-2x}+2x-3$

(16c) $y=(A+Bx)e^x+e^{2x}$

(16d) $y=(A+Bx)e^{-2x}+\frac{1}{2}x-\frac{3}{4}$

(16e) $y=A\cos x+B\sin x-\frac{1}{3}\cos 2x$

(16f) $y=A\cos 3x+B\sin 3x+\frac{4}{37}e^{\frac{1}{2}x}$

(17a) $y=-\frac{13}{2}e^x+\frac{5}{2}e^{3x}+4$

(17b) $y=-\frac{1}{2}(\cos x+\sin x-e^x)$

(17c) $y=(1-\frac{1}{2}x)e^x-\frac{1}{2}\sin x$

(17d) $y=\frac{9}{4}e^x+\frac{1}{12}e^{5x}-\frac{1}{3}e^{2x}$

(17e) $y=2e^{-x}\cos x+2x-2$

(17f) $y=\frac{1}{2}(e^{-2x}+1)(x+1)$

BHASVIC MαTHS

ASSIGNMENT _____ COVER SHEET

Name _____ Maths Teacher _____

Question	Done	Backpack	Ready for test	Notes
Drill A				
Drill B				
1				
2				
3				
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