2013 Mathematics (1)

Section A

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Section B

11W

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12Z

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Solution(s):

From user: ar857

13Z

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14T

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Solution(s):

From user: ar857

2013 Paper I 14T

14T a) $|a \times b|^2 = (|a||b|\sin\alpha)^2 = |a^2||b^2|\sin^2\alpha = |a|^2|b|^2 - |a|^2|b|^2\cos^2\alpha = |a|^2|b|^2 - (a \cdot b)^2$

b) $S_\Delta = \frac{1}{2}|R_1 - R_0||R_2 - R_0|\sin\alpha = \frac{1}{2}|R_1 - R_2| \cdot D$

$\Rightarrow D = \frac{|R_1 - R_0||R_2 - R_0|\sin\alpha}{|R_1 - R_2|} = \frac{|(R_1 - R_0) \times (R_2 - R_0)|}{|R_1 - R_2|}$

c) $A[4,2,1]$ $CA(2,1,-2)$

$B[0,1,1]$ $CB(-2,0,-2)$ $CA \times CB = (-2,8,2)$

$C[2,1,3]$ $x - 4y - z + 5 = 0$

d) $z[0,0,5]$

$y[0,\frac{5}{4},0]$ $zx = (-5,0,-5)$ $zx \times zy = \frac{25}{4}, 25, -\frac{25}{4}$

$x[-5,0,0]$ $zy = (0,\frac{5}{4},-5)$

$A = \frac{1}{2}|zx \times zy| = \frac{25}{2} \cdot \sqrt{\frac{1}{8}+1} = \frac{75}{4\sqrt{2}} = \frac{75\sqrt{2}}{8}$
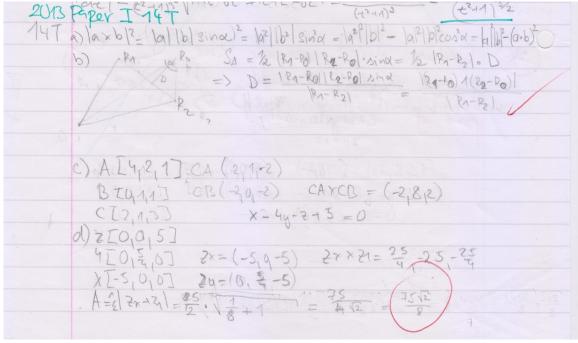
15R

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16Y

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Solution(s):

From user: ar857

2013 I B 16 ✓

b) ii) $\quad 4\,\dfrac{\partial^2 y}{\partial T^2} = 25\,\dfrac{\partial^2 y}{\partial x^2}$

$y = f(t)\cdot g(x)$

$\dfrac{\partial^2 y}{\partial t} = \dfrac{\partial f}{\partial t^2}\,gx \quad\Rightarrow\quad 4\,\dfrac{\partial^2 f}{\partial T^2}\,g(x) = 25\,\dfrac{\partial^2 g}{\partial x^2}\,f(x) = k^2$

$4\,\dfrac{\partial^2 f}{\partial T^2}\,\dfrac{1}{f(t)} = k^2 \qquad\qquad 25\,\dfrac{\partial^2 g}{\partial x^2}\,\dfrac{1}{g(x)} = k^2$

$y(x,0) = \sin 2x = f(x)\,g(0) \;\Rightarrow\; f(x) = \sin 2x$

$y(0,t) = f(0)\,g(t) = 0 \;\checkmark \qquad \sin 2x \cos 5t \;\checkmark$

$y = e^{\frac{k}{5}x} \cdot e^{\frac{k}{2}x} \;=\; y = \left(\cos\frac{k}{5}x + \sin\frac{k}{5}x\right)\left(\cos\frac{k}{2}t + \sin\frac{k}{2}t\right)$

$\dfrac{k}{5}x = 2 \;\Rightarrow\; k = 10$

$y = \sin 2x \cos 5t \;\Leftarrow\; t \;\text{initial conditions.}$

17S

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18S

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19X*

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20Y*

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