EXAMINATION PAPER 1	Matching the syllabus written by EDEXCEL Curriculum 2004+
Calculators Allowed ***Where appropriate give your answers to 3 s.f.***	
© ZigZag Education 2004	**Core Mathematics – C4**
Time Allowed:-1 hour 30 minutes	

1. $^{dy}/_{dx} = \sin^2 x$
When $x = 0.1$, $y = 0.2$. *[Note: x and y are given in radians.]*
Find $y = f(x)$ and evaluate any constants. **[6]**

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2. a) Expand the first four terms in the binomial expansion of $(1 - x)^{1/2}$, $|x| < 1$, in ascending powers of x. **[4]**
b) Letting $x = 10^{-2}$ in the above expansion, <u>hence</u> find $\sqrt{11}$ correct to 5 significant figures. **[3]**

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3. a) Calculate $\int xe^x \, dx$ **[5]**
b) Hence or otherwise calculate $\int x^2 e^x \, dx$ **[5]**

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4. a) A has position vector $-\mathbf{i} + \mathbf{j} + \mathbf{k}$ and B has position vector $\mathbf{i} + c\mathbf{j} + \mathbf{k}$ where c is a constant. If OA and OB are perpendicular then find c. **[4]**

L_1 has equation $\mathbf{r} = (\mathbf{i} + 2\mathbf{j} + \mathbf{k}) + \mu(3\mathbf{i} + 2\mathbf{j} + 3\mathbf{k})$, where μ is a scalar.
L_2 has equation $\mathbf{r} = (\mathbf{i} + \mathbf{k}) + \lambda(\mathbf{i} + \mathbf{j} + \mathbf{k})$, where λ is a scalar.
b) Calculate where the 2 lines cross. **[4]**
c) Calculate the acute angle between the lines. *Give your answer in degrees.* **[3]**

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5. $f(x) = \dfrac{x+1}{(x-1)(x+2)}$

a) Express $f(x)$ as partial fractions **[6]**
b) Calculate $f'(2)$. **[4]**
c) Calculate the area A, which is bounded by the curve $y = f(x)$ and the x-axis and the lines $x = 4$ and $x = 5$. Leave your answer exactly. **[4]**

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6. $x^2 + y^2 + 2x + 4y + 1 = 0$
a) Determine the coordinates of the points of this circle when $x = {}^1/_2$ **[3]**
c) Calculate $^{dy}/_{dx}$ in terms of x and y. **[6]**
d) Calculate the gradients of the 2 tangents to the curve when $x = {}^1/_2$ **[4]**
e) Calculate the equation of the tangent with a positive gradient. **[2]**

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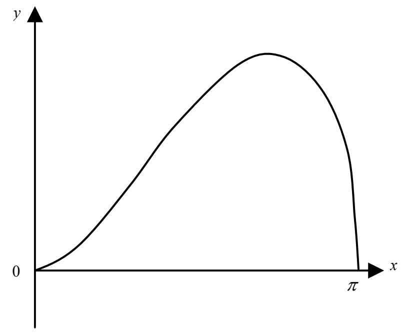
7. The sketch shows the finite region bounded by the curve $y = x\sin^{\frac{1}{2}} x$ and the x-axis, $0 \le x \le \pi$.



This region is rotated 2π radians about the x-axis,
Find the exact value of volume of the generated. **[12]**

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[75]

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Calculators Allowed ***Where appropriate give your answers to 3 s.f.***	
	Core Mathematics – C4
Time Allowed:-1 hour 30 minutes	

1. $y = 3e^{x}$
   a) Sketch this curve, stating where the curve crosses the y-axis. **[2]**
   b) Find the area bounded by the curve, the x-axis, the y-axis and the line $x = \ln 10$. **[4]**

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2. a) Calculate $\int_{1}^{4} \frac{1}{1+2x}\,dx$. *Give your answer exactly.* **[3]**

   b) Estimate $\int_{1}^{4} \frac{x}{1+2x}\,dx$ by using the trapezium rule with 3 intervals. **[5]**

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3. a) Expand the first four terms in the binomial expansion of $(1 + x)^{-3}$, $|x| < 1$, in ascending powers of x. **[5]**
   b) Hence expand the first four terms in the binomial expansion of $(4 + 4x)^{-3}$, $|x| < 1$, in ascending powers of x. **[2]**

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4. A pair of parametric equations are $x = t + 1$ and $y = t^2 + 2$.
   a) Formulate an equivalent Cartesian equation. **[3]**

   A curve's parametric equations are $x = \sin^3 t$ and $y = t + \cos t$
   b) Find ${}^{dy}/_{dx}$ as a function of t. **[4]**
   c) i) Find the gradient of the curve when $t = {}^{\pi}/_{4}$. **[2]**
      ii) Find the equation of the normal to the curve when $t = {}^{\pi}/_{4}$. **[5]**

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5. $f(x) = \dfrac{7}{(x + 6)(2x + 1)}$
   a) Express f(x) as partial fractions **[7]**
   b) Calculate f'(x) and hence find f'(1) leaving your answer as a fraction. **[4]**

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6. A has position vector $-\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ and B has position vector $\mathbf{i} + 2\mathbf{j} - 5\mathbf{k}$.

   a) Calculate the position vector $\overrightarrow{AB}$. **[3]**

   b) Calculate the unit vector of $\overrightarrow{AB}$. **[2]**
   c) Calculate the vector equation of the straight line that passes through A and B. **[2]**
   A second straight line also passes through B and through the origin 0.
   d) Find the acute angle between the line in c) and this 2nd line. *Give your answer in degrees.* **[5]**

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7. a) Calculate $\int_{0}^{\frac{\pi}{4}} \sin x \cos x\,dx$ **[4]**
   b) Calculate $\int e^{x} \sin x\,dx$ by using integration by parts twice.
   [8]

   A curve is defined implicitly as $x \sin x = y \cos y$.

c) Find $\frac{dy}{dx}$ in terms of x and y. **[5]**

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[75]

EXAMINATION PAPER 3	Matching the syllabus written by EDEXCEL Curriculum 2004+
Calculators Allowed ***Where appropriate give your answers to 3 s.f.***	
	Core Mathematics – C4
Time Allowed:-1 hour 30 minutes	

1. $y = 3 - 2e^x$
   a) Sketch this curve, stating where the curve crosses the x-axis and the y-axis. **[3]**
   b) Find the area bounded by the curve, the x-axis and the lines $x = 2$ and $x = 3$. **[5]**

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2. a) Expand the first four terms in the binomial expansion of $(1 - 4x)^{1/2}$, $|x| < 1/4$, in ascending powers of x. **[5]**
   b) Let $x = 10^{-2}$ and hence find $\sqrt{6}$ correct to 5 significant figures. **[4]**

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3. A curve's parametric equations are $x = \sin^2 t$ and $y = 1 + \cos t$
   a) Find dy/dx as a function of t. **[4]**
   b) Find A where, the gradient of the curve is $A\sqrt{2}$, when $t = \pi/4$. **[2]**
   c) Eliminate t from the parametric equations and therefore find an equivalent Cartesian equation of the curve. **[3]**

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4. a) Calculate $\int \sin x \cos^3 x \, dx$ **using** the substitution $u = \cos x$. *Show your working to gain full marks.* **[5]**
   b) Finding A and B; write $2\sin 6x \cos 5x$ in the form $\sin Ax + \sin Bx$ **[3]**
   c) Using your result from b) or otherwise integrate $\int \sin 6x \cos 5x \, dx$ **[3]**

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5. $f(x) = \dfrac{x + 1}{(x - 1)^2(x + 2)}$
   a) Express $f(x)$ as partial fractions **[6]**
   b) Calculate $f'(2)$. **[2]**
   c) Calculate the area A, which is bounded by the curve $y = f(x)$, the x-axis and the lines $x = 4$ and $x = 5$. Leave your answer exactly. **[5]**

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6. a) Calculate $\int_1^4 e^x \, dx$ **[3]**
   b) i) Estimate $\int_1^4 e^{-x} \, dx$ by using the trapezium rule with 3 intervals. **[4]**
      ii) Explain with the aid of a diagram explain whether your answer is an over or under estimation of the exact integral and give a method of improving the accuracy using the trapezium rule. **[2]**
   c) What is the relationship between the graphs of $f(x)$ and $g(x)$, where $f(x) = e^x$ and $g(x) = e^{-x}$? **[1]**

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7. A has position vector $-\mathbf{i} - 2\mathbf{j} + \mathbf{k}$ and B has position vector $\mathbf{i} + 2\mathbf{j} + \mathbf{k}$.

   a) Calculate the position vector $\overrightarrow{AB}$. **[2]**

   b) Calculate the unit vector of $\overrightarrow{OA}$. (O the origin). **[3]**
   c) Calculate the distance between A and B. **[2]**

   L_1 has equation $\mathbf{r} = (\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}) + \mu(3\mathbf{i} + 2\mathbf{j} + \mathbf{k})$, where μ is a scalar quantity.
   L_2 has equation $\mathbf{r} = (3\mathbf{i} + 2\mathbf{j} + \mathbf{k}) + \lambda(\mathbf{i} + 2\mathbf{j} + A\mathbf{k})$, where A is a constant and λ is a scalar quantity.
   d) Given that the 2 lines intersect find the value of A. **[4]**
   e) Calculate the acute angle between the lines. *Give your answer in degrees.* **[4]**

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Time Allowed:-1 hour 30 minutes	

1. A pair of parametric equations are, $x = 3\cos 2t$ and $y = 3\sin 2t$.
Formulate an equivalent Cartesian equation and describe the nature of this curve. **[6]**

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2. $^{dy}/_{dx} = x + \sin x$ and $x = 0.1$ when $y = 0.2$. *The value of x is given in radians.*
Find $y = f(x)$ and evaluate any constants. **[5]**

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3. a) Expand the first four terms in the binomial expansion of $(1 - 2x)^{1/2}$, $|x| < {}^{1}/_{2}$, in ascending powers of x. **[4]**
b) By letting $x = 10^{-2}$ in the above expansion, find an approximation of $\sqrt{2}$ correct to 5 significant figures. **[4]**

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4. a) Calculate $\int x \sin x \, dx$ **[5]**
b) Hence or otherwise calculate $\int x^2 \cos x \, dx$ **[5]**

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5. A curve's parametric equations are $x = \cos 6t$ and $y = \cos^2 t$
a) Find $^{dy}/_{dx}$ as a function of t. **[5]**
b) Find the gradient of the curve when $t = {}^{\pi}/_{4}$ **[2]**
c) Find the equation of the normal to the curve when $t = {}^{\pi}/_{4}$. **[3]**

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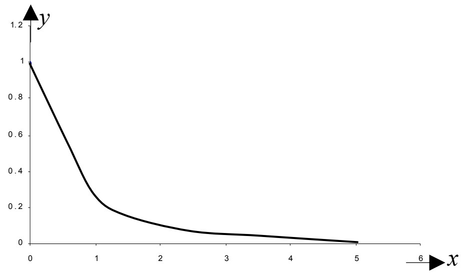
6. a) $\int \frac{x^3}{x^4+1} dx$ **[2]**
b) Calculate $\int_1^5 x^{\frac{1}{2}} + e^x dx$. *Give your answer to 1 decimal place.* **[4]**
c) Estimate $\int_1^5 \frac{1}{x^{\frac{1}{2}} + e^x} dx$ by using the trapezium rule with 4 intervals.

A sketch of $y = \frac{1}{x^{\frac{1}{2}} + e^x}$ is shown, sketch the area represented by this integral and state whether the trapezium rule gives an over or under estimate of the integral. Shade onto your sketch this over or under estimate between $x = 1$ and $x = 2$. **[6]**



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7. A has position vector $-\mathbf{i} + \mathbf{j} + \mathbf{k}$
B has position vector $3\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$
C has position vector $c\mathbf{i} + \mathbf{j} + 5\mathbf{k}$ where c is a constant.

a) Calculate the acute angle between the position vectors $\overrightarrow{OA}$ and $\overrightarrow{OB}$, where O is the origin. *Give you answer in degrees.* **[4]**
b) Calculate the length between point A and B. **[2]**

c) Given that the position vectors $\overrightarrow{AC}$ and $\overrightarrow{AB}$ are perpendicular, then find c. **[5]**
d) Give the vector equation of the straight line that passes through A and B. **[2]**

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8. $f(x) = \frac{12x}{(x + 1)(2x + 1)}$

a) Express $f(x)$ in partial fractions. **[3]**

b) Calculate f'(x). **[2]**

c) Expand f(x) as a series of ascending powers of x, up to and including the term involving x^2.

Clearly indicate in your answer to c) the range of values for which the expansion is valid. **[6]**

[75]

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	Core Mathematics – C4
Time Allowed:-1 hour 30 minutes	

1. The area bounded by the curve $y = e^{x/2}$ the x-axis and the lines $x = 2$ and $x = 3$ is rotated 360^0 about the x-axis. Find, leaving your answer exactly, and using integration, the volume formed. **[5]**

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2. $^{dy}/_{dx} = x + e^x$ and $x = 1$ when $y = 2$.
Solve the differential equation & write your answer in the form $y = f(x)$ & evaluate any constants. **[5]**

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3. A curve's parametric equations are $x = \sin t$ and $y = \sin 3t$.
   a) Find $^{dy}/_{dx}$ as a function of t. **[4]**
   b) Find the gradient of the curve when $t = {}^{\pi}/_{4}$. **[2]**
   c) Find the equation of the tangent to the curve when $t = {}^{\pi}/_{4}$. **[3]**

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4. a) Given that $2\sin 2x\cos 4x + \cos 2x\sin 4x \equiv {}^1/_2[3\sin 6x - \sin 2x]$ find,
   $\int (4\sin 2x\cos 4x + 2\cos 2x\sin 4x)\,dx$ **[4]**

   b) **Using** the substitution $u = \sin x$, find $\int_0^{\frac{\pi}{6}} 16\cos x\sin^4 x\,dx$
   Show your working to gain full marks. **[4]**

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5. A has position vector $\mathbf{i} + \mathbf{j} + \mathbf{k}$
B has position vector $b\mathbf{i} - b\mathbf{j} + 13\mathbf{k}$, where b is a constant.
C has position vector $2\mathbf{i} - \mathbf{j} - 2\mathbf{k}$
The distance between the points A and B is 14 units.
   a) Find the possible values of b. **[4]**
   b) Calculate the acute angle between the position vectors OA and OC, where O is the origin.
   Give your answer in degrees. **[7]**
   c) Find the vector equation of the straight line that passes through A and C and **show** that the line passes through the point $17\mathbf{i} - 31\mathbf{j} - d\mathbf{k}$ and find d. **[5]**

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6. A pair of parametric equations are, $x = 2\cos t$ and $y = 3\sin t$.
   a) i) Formulate an equivalent Cartesian equation of this curve. **[5]**
      ii) Using implicit differentiation find a formula for $\frac{dy}{dx}$ in terms of x and y. **[5]**

   b) i) Using the chain rule find $\frac{dy}{dx}$ in terms of t. **[3]**
      ii) Hence determine $\frac{dy}{dx}$ in terms of x and y and show that this is the same as your answer in a)ii). **[2]**

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7. $$f(x) = \frac{36x}{(2x+1)(x+2)}$$
   a) Express f(x) as partial fractions. **[6]**
   b) Expand f(x) as a series of ascending powers of x, up to and including the term involving x^2.

Clearly indicate in your answer to b) the range of values for which the expansion is valid. **[11]**

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[75]