## Core Mathematics C2

## Advanced Subsidiary

Extension Practice Paper

Time: 1 hour 30 minutes
(1) In the binomial expansion of $(p+q x)^{r}$ where $0<p<q<r<8$ the constant is 16 and the coefficients of the terms in $x^{3}$ and $x^{2}$ are equal. Find the values of the integers $p, q$ and $r$ showing clearly how you found each.
(2) Two circles $C_{1}$ and $C_{2}$ both have the coordinate axes as tangents.

The equation of $C_{1}$ is $(x-a)^{2}+(y-b)^{2}=25$ where $a<0, b>0$
The equation of $C_{2}(x-c)^{2}+(y-d)^{2}=16$ where $c, d>0$
$C_{1}$ touches the $x$ axis at the point $A$ and has its centre at the point $B$
$C_{2}$ touches the $x$ axis at the point $D$ and has its centre at the point $C$
Find the area of the quadrilateral $A B C D$ giving your answer as an exact fraction.
(9 marks)
(3) $r(x)=p \cos ^{2}(x)-1, p>1$
(a) Sketch the graph of $y=r(x)$ for $-2 \pi \leq x \leq 2 \pi$ showing any points where the graph meets or crosses the coordinate axes.

The line $y=1$ intersects the graph $y=s(x)$ where $s(x)=t \cos ^{2}(x)-1, t>0$ four times in the interval $-2 \pi \leq x \leq 0$. Given the vertical distance between the maximum and minimum points of $s(x)$ is 4 (b) Find the $x$ coordinates of the four points of intersection of $y=1$ and $y=s(x)$ for $-2 \pi \leq x \leq 0 \quad$ (6 marks)
(4) The function $h(x)$ is transformed to give the function $g(x)$ where $g(x)=x^{3}+x^{2}-20 x$. The transformation from $h(x)$ to $g(x)$ is a scale factor stretch of 0.5 parallel to the $x$ axis. Find the area trapped between the curve and the $x$ axis for the function $h(x)$.
(9 marks)
(5) A circle has equation $(x-a)^{2}+(y-a)^{2}=a^{2}$ where $a$ is a constant. The line $y+x-a=0$ splits the area of the circle into 2 parts, $A_{1}$ and $A_{2}$ where $A_{1}>A_{2}$. Find the area of $A_{2}$ giving your answer in the form $\frac{a^{2}}{b}(c \pi+d)$ where $b, c$ and $d$ are integers.
(8 marks)
(6) A geometric series has first term $a$ and common ratio $r$ where $a$ and $r$ are positive constants.

The fourth term of the series is $p^{-1}$, the sum to infinity of the series is $p$ and the sum of the first two terms of the series is $0.75 p$ where $p$ is a positive constant. Find the values of $a, r$ and $p$.
(9 marks)
(7) The points $A B C D$ with coordinates $A(3,1), B(8,6), C(11,-3)$ and $D(p, q)$ all line on the circumference of a circle drawn clockwise from $A$ to $D$. Find the size of angle $C D A$ giving your answer in radians to 3 SF .
(9 marks)
(8) In the triangle $A B C$ the length $B C=6 \mathrm{~cm}$.

Find the size of angle $C A B$ in radians and the perimeter of triangle $A B C$.
You must show clearly how you found your answers.
(9 marks)

(9) Point $A(2,1)$ and point $B(4,2)$ form part of the regular hexagon $A B C D E F$.

Find the area of triangle $A C E$ in the form $p \sqrt{q}$ where $p$ and $q$ are rational constants.

