Mark Scheme for June 2010
OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today’s society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners’ meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates’ scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

© OCR 2010

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk
1 Derive/quote \( g'(x) = \frac{p}{1+x^2} \)
   Attempt \( f'(x) = \frac{a}{1+bx^2} \)
   Use \( x = \frac{1}{2} \) to set up a solvable equation in \( p \), leading to at least one solution
   Get \( p = \frac{5}{4} \) only
   \( \text{B1} \)

   \( \text{M1} \) Allow any \( a, b = 2 \) or 4

   \( \text{M1} \)

   \( \text{A1} \) AEEF

2 Reasonable attempt at \( e^{2x} (1+2x+2x^2) \)
   Multiply out their expressions to get all terms up to \( x^2 \)
   Get \( 1+3x+4x^2 \)
   Use binomial, equate coefficients to get 2 solvable equations in \( a \) and \( n \)
   Reasonable attempt to eliminate \( a \) or \( n \)
   Get \( n = 9, a = \frac{1}{3} \)
   \( \text{M1} \)

   \( \text{M1} \) 3 terms of the form \( 1+2x+ax^2, a \neq 0 \)

   \( \text{M1} \) (3 terms) x (minimum of 2 terms)

   \( \text{A1} \) cao

   \( \text{M1} \) Reasonable attempt at binomial, each term involving \( a \) and \( n \) \((an=3, a^2n(n-1)/2=4)\)

   \( \text{M1} \)

   \( \text{A1} \) cao

   SC Reasonable f’(x) and f''(x) using product rule (2 terms)
   Use their expressions to find f'(0) and f''(0)
   Get 1+3x+4x^2 cao
   \( \text{A1} \)

3 Quote/derive correct \( dx = 2dt/(1+t^2) \)
   Replace all \( x \) (not \( dx = dr \))
   Get \( 2/(t-1)^2 \) or equivalent
   Reasonable attempt to integrate their expression
   Use correct limits in their correct integral
   Clearly tidy to \( \sqrt{3} + 1 \) from cwo
   \( \text{B1} \)

   \( \text{M1} \) From their expressions

   \( \text{A1} \)

   \( \text{M1} \)

   \( \text{A1} \sqrt{} \) Must involve \( \sqrt{3} \)

   \( \text{A1} \) A.G.

4 (i) Get \( a = -2 \)
   Get \( b = 6 \)
   Get \( c = 1 \)
   \( \text{B1} \) May be quoted
   \( \text{B1} \) May be quoted
   \( \text{B1} \) May be quoted

(ii) \( \text{B1} \) Correct shape in \(-1 < x \leq 3\) only
   (allow just top or bottom half)

   \( \text{B1} \ 90^0 \) (at \( x=3 \)) (must cross \( x \)-axis i.e. symmetry)

   \( \text{B1} \) Asymptote at \( x = -1 \) only (allow \(-1 \) seen)

   \( \text{B1} \sqrt{} \) Correct crossing points; \( \pm \sqrt{(b/c)} \) from their \( b, c \)
5 (i) Reasonable attempt at parts
Get $e^{x}(1-2x)^{n} - \int e^{x}.n(1-2x)^{n-1}.dx$
Evidence of limits used in integrated part
Tidy to A.G.

(ii) Show any one of $I_{3}=6I_{2}-1, I_{2}=4I_{1}+1, I_{1}=2I_{0}-1$
Get $I_{0}(=e^{\frac{1}{2}}-1) or I_{1}(=2e^{\frac{1}{2}}-3)$
Substitute their values back for their $I_{3}$
Get $48e^{\frac{1}{2}} - 79$

6 (i) Reasonable attempt to differentiate
$\sinh y = x$ to get $\frac{dy}{dx}$ in terms of $y$
Replace $\sinh y$ to A.G.

(ii) Reasonable attempt at chain rule
Get $\frac{dy}{dx} = a \sinh(\sinh^{-1}x)/\sqrt{x^{2}+1}$
Reasonable attempt at product/quotient
Get $\frac{d^{2}y}{dx^{2}}$ correctly in some form
Substitute in and clearly get A.G.

7 (i) Get 5.242, 5.239, 5.237
Get 5.24

(ii) Show reasonable staircase for any region
Describe any one of the three cases
Describe all three cases

(iii) Reasonable attempt to use log/expo. rules
Clearly get A.G.
Attempt $f'(x)$ and use at least once in correct N-R formula
Get answers that lead to 1.31

(iv) Show $f'(\ln 36) = 0$
Explain why N-R would not work
8 (i) Use correct definition of \( \cosh x \)  
Attempt to cube their definition involving \( e^x \) and \( e^{-x} \) (or \( e^{2x} \) and \( e^x \)) 
Put their 4 terms into LHS and attempt to simplify 
Clearly get A.G.  
B1  
M1 Must be 4 terms  
M1  
A1  

(ii) Rewrite as \( k\cosh 3x = 13 \)  
Use ln equivalent on \( 13/k \)  
Get \( x = (\pm) \frac{1}{2} \ln 5 \)  
Replace in \( \cosh x \) for \( u \)  
Use \( e^{\ln b} = b^x \) at least once  
Get \( \frac{1}{2}(5^{\frac{1}{3}} + 5^{-\frac{1}{3}}) \)  
A1  
M1  
A1  

9 (i) Attempt integral as \( k(2x+1)^{1.5} \)  
Get 9  
A1 cao  

(ii) Use \( r^2 = x^2 + y^2 \) and \( x = r \cos \theta, y = r \sin \theta \)  
Eliminate \( x \) and \( y \) to produce quadratic equation (=0) in \( r \) (or \( \cos \theta \))  
Solve their quadratic to get \( r \) in terms of \( \theta \) (or vice versa)  
Clearly get A.G.  
Clearly show \( \theta_1 \) (at \( B \)) = \( \tan^{-1} \frac{3}{4} \) and \( \theta_2 \) (at \( A \)) = \( \pi \)  
A1 \( r > 0 \) may be assumed  
B1  
M1  
A1  

(iii) Use area = \( \frac{1}{2} \int r^2 \, d\theta \) with correct \( r \)  
Rewrite as \( k \csc^4(\frac{\theta}{2}) \)  
Equate to their part (i) and tidy  
Get 24  
B1 cwo; ignore limits  
M1 Not just quoted  
M1 To get \( f = \) some constant  
A1 A.G.
OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored