1 Introduce logarithms and use power law twice **M1***
Obtain $(x+3)\log 5 = (x-1)\log 7$ or equivalent **A1**
Solve linear equation for x **M1 dep**
Obtain 20.1 **A1** [4]

2 Use quotient rule or, after adjustment, product rule **M1***
Obtain $\frac{3x-15-3x-1}{(x-5)^2}$ or equivalent **A1**
Equate first derivative to –4 and solve for x **M1 dep**
Obtain x-coordinates 3 and 7 or one correct pair of coordinates **A1**
Obtain y-coordinates –5 and 11 respectively or other correct pair of coordinates **A1** [5]

3 **(i)** State or imply $R = 17$ **B1**
Use appropriate formula to find α **M1**
Obtain 61.93 **A1** [3]

(ii) Attempt to find at least one value of $\theta + \alpha$ **M1**
Obtain one correct value of θ (97.4 or 318.7) **A1**
Carry out correct method to find second answer **M1**
Obtain second correct value and no others between 0 and 360 **A1** [4]

4 **(i)** Make a recognisable sketch of $y = \ln x$ **B1**
Draw straight line with negative gradient crossing positive y-axis and justify one real root **B1** [2]

(ii) Consider sign of $\ln x + \frac{1}{2}x - 4$ at 4.5 and 5.0 or equivalent **M1**
Complete the argument correctly with appropriate calculations **A1** [2]

(iii) Use the iterative formula correctly at least once **M1**
Obtain final answer 4.84 **A1**
Show sufficient iterations to justify accuracy to 2 d.p. or show sign change in interval (4.835, 4.845) **A1** [3]

5 **(a)** Use $\tan^2 x = \sec^2 x - 1$ **B1**
Obtain integral of form $p\tan x + qx + r\cos 2x$ **M1**
Obtain $\tan x - x - \frac{1}{2}\cos 2x + c$ **A1** [3]

(b) Obtain integral of form ke^{1-2x} **M1***

Obtain $-\frac{3}{2}e^{1-2x}$ **A1**

Apply both limits the correct way round **M1 dep**

Obtain $-\frac{3}{2}e^{-1}+\frac{3}{2}e$ or exact equivalent **A1** [4]

6 (i) Carry out division at least as far as quotient x^2+kx **M1**

Obtain partial quotient x^2+2x **A1**

Obtain quotient x^2+2x+1 with no errors seen **A1**

Obtain remainder $5x+2$ **A1** [4]

(ii) Either Carry out calculation involving $12x+6$ and their remainder $ax+b$ **M1**

Obtain $p=7, q=4$ **A1**

Or Multiply x^2-x+4 by their three-term quadratic quotient **M1**

Obtain $p=7, q=4$ **A1** [2]

(iii) Show that discriminant of x^2-x+4 is negative **B1**

Form equation $(x^2-x+4)(x^2+2x+1)=0$ and attempt solution **M1**

Show that $x^2+2x+1=0$ gives one root $x=-1$ **A1** [3]

7 (i) Obtain $12\sin t\cos t$ or equivalent for $\frac{dx}{dt}$ **B1**

Obtain $4\cos 2t-6\sin 2t$ or equivalent for $\frac{dy}{dt}$ **B1**

Obtain expression for $\frac{dy}{dx}$ in terms of t **M1**

Use $2\sin t\cos t=\sin 2t$ **A1**

Confirm given answer $\frac{dy}{dx}=\frac{2}{3}\cot 2t-1$ with no errors seen **A1** [5]

(ii) State or imply $\tan 2t=\frac{2}{3}$ **B1**

Obtain $t=0.294$ **B1**

Obtain $t=1.865$ **B1** [3]

(iii) Attempt solution of $2\sin 2t+3\cos 2t=0$ at least as far as $\tan 2t=\ldots$ **M1**

Obtain $\tan 2t=-\frac{3}{2}$ or equivalent **A1**

Substitute to obtain $-\frac{13}{9}$ **A1** [3]