1	Solve	the eq	uation

Give the answer correct to 3 decimal places. [3]	$\ln(1 + \mathrm{e}^{-3x}) = 2.$		
		[3]	
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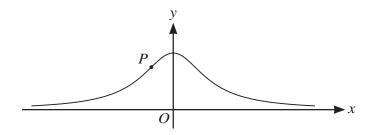
	coefficients.
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	State the set of values of $x$ for which the expansion is valid. [
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(a)	By taking logarithms, show that the graph of <i>y</i> against <i>x</i> is a straight line. State the exact va of the gradient of this line.
(b)	Find the exact <i>x</i> -coordinate of the point of intersection of this line with the line $y = 3x$ . Give you ln $a$
(b)	Find the exact x-coordinate of the point of intersection of this line with the line $y = 3x$ . Give you answer in the form $\frac{\ln a}{\ln b}$ , where a and b are integers.
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(b)	Find the exact <i>x</i> -coordinate of the point of intersection of this line with the line $y = 3x$ . Give $y$ answer in the form $\frac{\ln a}{\ln b}$ , where $a$ and $b$ are integers.
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$\tan^2\theta + 3\sqrt{3}\tan\theta - 2 = 0.$	[3
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Hence solve the equation $\tan(\theta + 60^\circ) = 2 \cot \theta$ , for $0^\circ < \theta < 180^\circ$ .	[3]
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5



The diagram shows the curve with parametric equations

$$x = \tan \theta$$
,  $y = \cos^2 \theta$ ,

for  $-\frac{1}{2}\pi < \theta < \frac{1}{2}\pi$ .

(a)	Show that the gradient of the curve at the point with parameter $\theta$ is $-2\sin\theta\cos^3\theta$ .	[3]
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The gradient of the curve has its maximum value at the point P.

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6 The complex number u is defined by

$$u = \frac{7 + i}{1 - i}.$$

(a)	Express $u$ in the form $x + iy$ , where $x$ and $y$ are real.	[3]
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(b) Show on a sketch of an Argand diagram the points A, B and C representing u, 7 + i and 1 - i respectively. [2]



	$\tan^{-1}\left(\frac{4}{3}\right) = \tan^{-1}\left(\frac{1}{7}\right) + \frac{1}{4}\pi.$	[3
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		[1] 35t

7 The variables x and t satisfy the differential equation

$$e^{3t} \frac{\mathrm{d}x}{\mathrm{d}t} = \cos^2 2x,$$

for  $t \ge 0$ . It is given that x = 0 when t = 0.

[7]	Solve the differential equation and obtain an expression for $x$ in terms of $t$ .
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State what happens to the value of $x$ when $t$ tends to infinity.	[1]
	700

**(b)** 

**8** With respect to the origin O, the position vectors of the points A, B, C and D are given by

$$\overrightarrow{OA} = \begin{pmatrix} 2 \\ 1 \\ 5 \end{pmatrix}, \quad \overrightarrow{OB} = \begin{pmatrix} 4 \\ -1 \\ 1 \end{pmatrix}, \quad \overrightarrow{OC} = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} \quad \text{and} \quad \overrightarrow{OD} = \begin{pmatrix} 3 \\ 2 \\ 3 \end{pmatrix}.$$

(a)	Show that $AB = 2CD$ .	[3]
<b>(b)</b>	Find the angle between the directions of $\overrightarrow{AB}$ and $\overrightarrow{CD}$ .	[3]

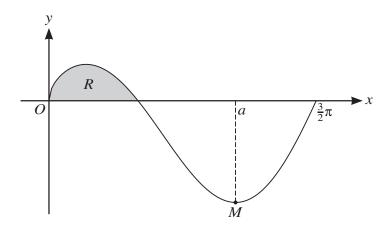
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9 Let  $f(x) = \frac{7x + 18}{(3x + 2)(x^2 + 4)}$ .

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Hence find the exact value of $\int_0^2 f(x) dx$ .	
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**10** 



The diagram shows the curve  $y = \sqrt{x} \cos x$ , for  $0 \le x \le \frac{3}{2}\pi$ , and its minimum point M, where x = a. The shaded region between the curve and the x-axis is denoted by R.

(a)	Show that a satisfies the equation $\tan a = \frac{1}{2a}$ .	[3]

**(b)** The sequence of values given by the iterative formula  $a_{n+1} = \pi + \tan^{-1}\left(\frac{1}{2a_n}\right)$ , with initial value  $x_1 = 3$ , converges to a.

Use this formula to determine *a* correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

Give your answer in terms of $\pi$ .	[6
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