Cambridge
O Level

**Cambridge International Examinations**
Cambridge Ordinary Level

| | |
|---|---|
| CANDIDATE NAME | |
| CENTRE NUMBER | |
| CANDIDATE NUMBER | |

*9835984090*

**ADDITIONAL MATHEMATICS** **4037/11**

Paper 1 **May/June 2014**

**2 hours**

Candidates answer on the Question Paper.

No additional materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.



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***Mathematical Formulae***

## 1. ALGEBRA

*Quadratic Equation*

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

*Binomial Theorem*

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1}\, b + \binom{n}{2} a^{n-2}\, b^2 + \ldots + \binom{n}{r} a^{n-r}\, b^r + \ldots + b^n,$$

where $n$ is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

## 2. TRIGONOMETRY

*Identities*

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

*Formulae for $\Delta ABC$*

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

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**1** Show that $\tan\theta + \dfrac{\cos\theta}{1+\sin\theta} = \sec\theta$. [4]

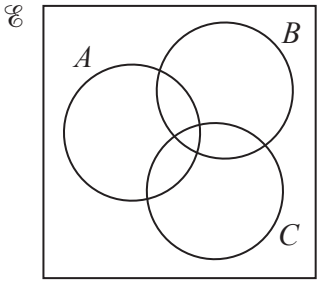
**2** Vectors **a**, **b** and **c** are such that $\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$.

**(i)** Show that $|\mathbf{a}| = |\mathbf{b} + \mathbf{c}|$. [2]

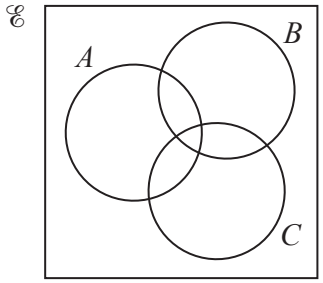
**(ii)** Given that $\lambda\mathbf{a} + \mu\mathbf{b} = 7\mathbf{c}$, find the value of $\lambda$ and of $\mu$. [3]

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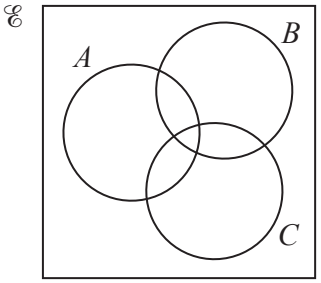
**3** **(a)** On the Venn diagrams below, shade the regions indicated.




**(i)** $A \cap B \cap C$




**(ii)** $(A \cup B) \cap C'$




**(iii)** $A \cup (B \cap C')$

[3]

**(b)** Sets $P$ and $Q$ are such that

$$P = \{x : x^2 + 2x = 0\} \text{ and } Q = \{x : x^2 + 2x + 7 = 0\}, \text{ where } x \in \mathbb{R}.$$

**(i)** Find $\mathrm{n}(P)$. [1]

**(ii)** Find $\mathrm{n}(Q)$. [1]

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**[Turn over**

**4** Find the set of values of $k$ for which the line $y = k(4x - 3)$ does not intersect the curve $y = 4x^2 + 8x - 8$. [5]

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**5** **(i)** Given that $y = e^{x^2}$, find $\frac{dy}{dx}$. [2]

**(ii)** Use your answer to part **(i)** to find $\int xe^{x^2} dx$. [2]

**(iii)** Hence evaluate $\int_0^2 xe^{x^2} dx$. [2]

**6** Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} -1 & 4 \\ 7 & 6 \\ 4 & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 2 & 1 \\ 3 & 5 \end{pmatrix}$.

**(i)** Find **AB**. [2]

**(ii)** Find $\mathbf{B}^{-1}$. [2]

**(iii)** Using your answer to part **(ii)**, solve the simultaneous equations

$$4x + 2y = -3,$$
$$6x + 10y = -22.$$

[3]

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**7** A curve is such that $\frac{dy}{dx} = 4x + \frac{1}{(x+1)^2}$ for $x > 0$. The curve passes through the point $\left(\frac{1}{2}, \frac{5}{6}\right)$.

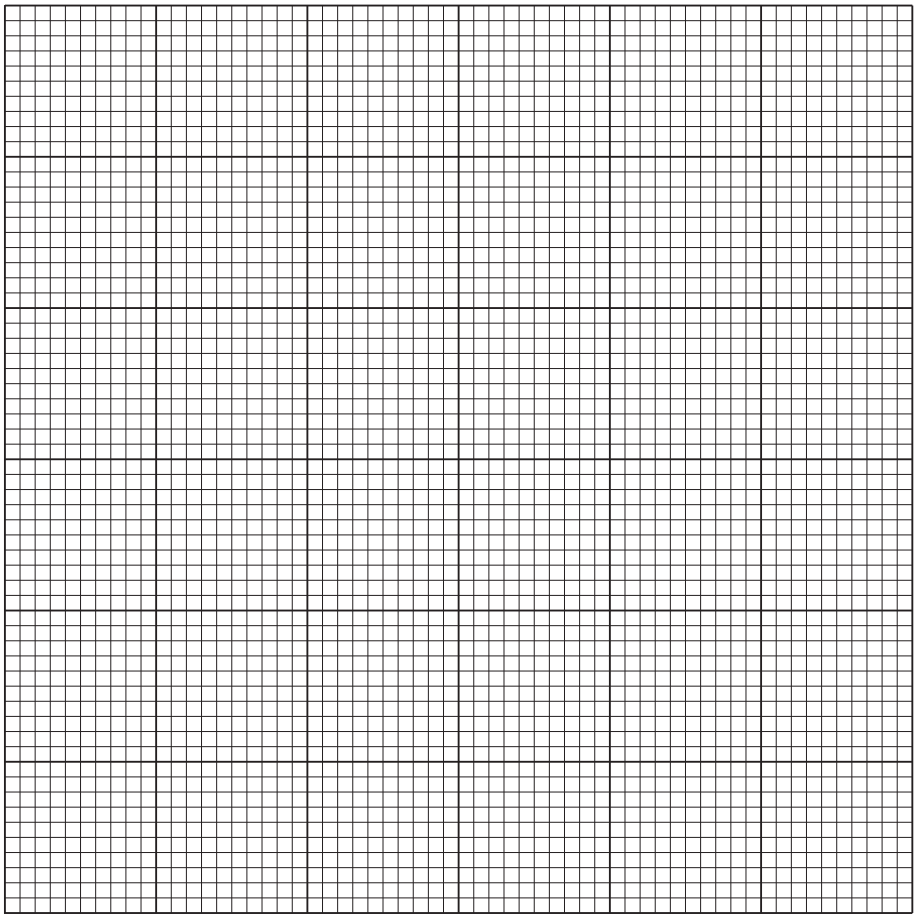
**(i)** Find the equation of the curve. [4]

**(ii)** Find the equation of the normal to the curve at the point where $x = 1$. [4]

**8** The table shows values of variables $V$ and $p$.

| $V$ | 10 | 50 | 100 | 200 |
|---|---|---|---|---|
| $p$ | 95.0 | 8.5 | 3.0 | 1.1 |

**(i)** By plotting a suitable straight line graph, show that $V$ and $p$ are related by the equation $p = kV^n$, where $k$ and $n$ are constants. [4]



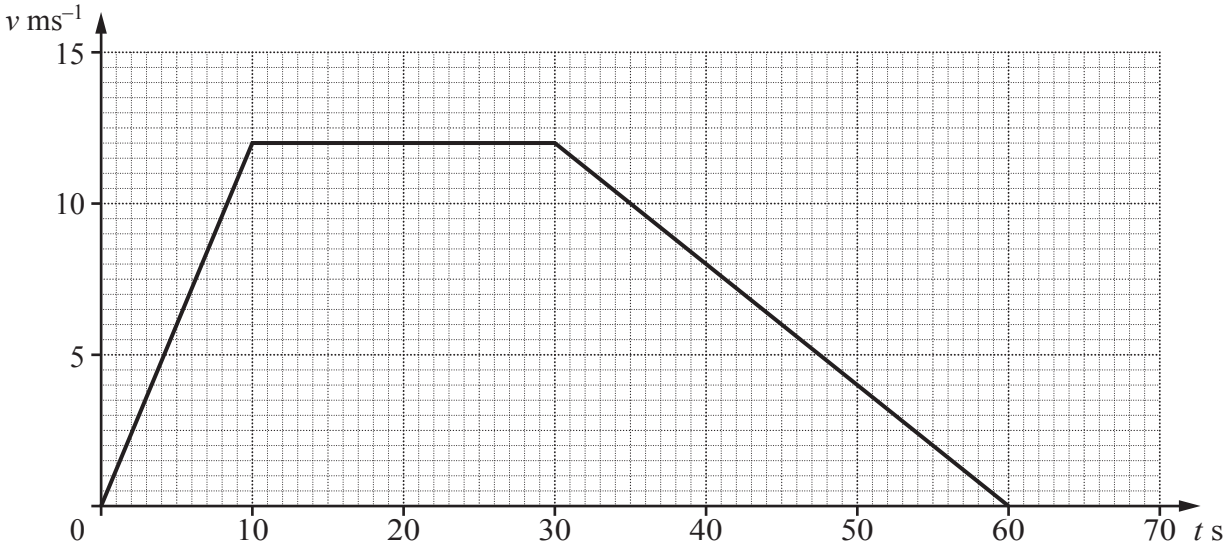
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Use your graph to find

**(ii)** the value of $n$, [2]

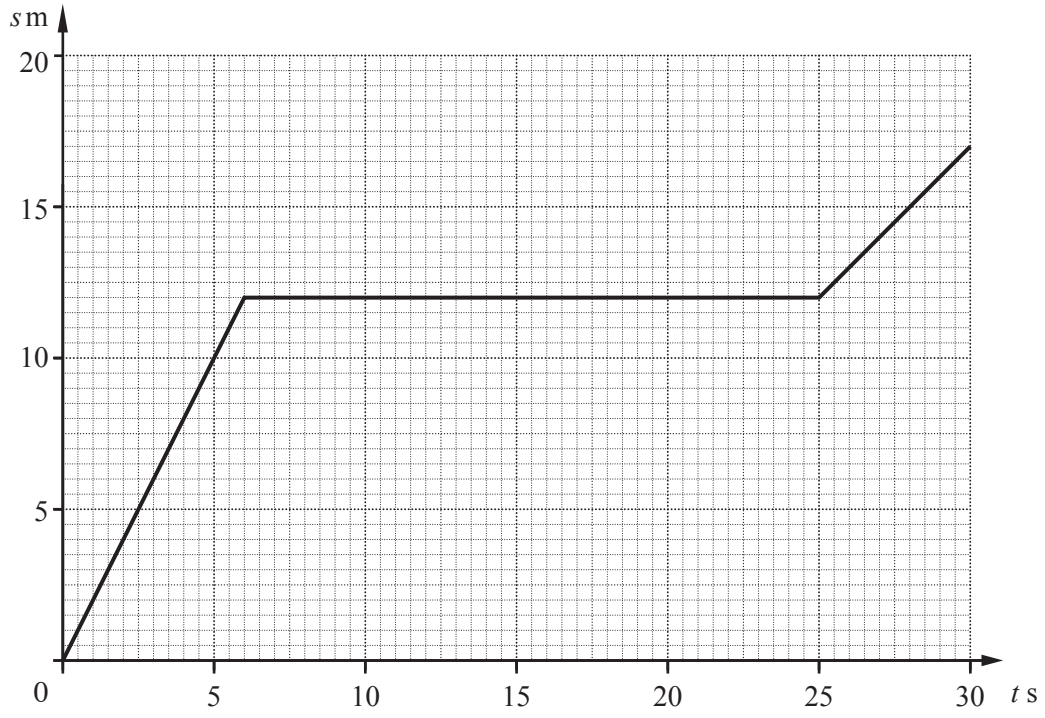
**(iii)** the value of $p$ when $V = 35$. [2]

**9** **(a)** The diagram shows the velocity-time graph of a particle $P$ moving in a straight line with velocity $v$ ms$^{-1}$ at time $t$ s after leaving a fixed point.

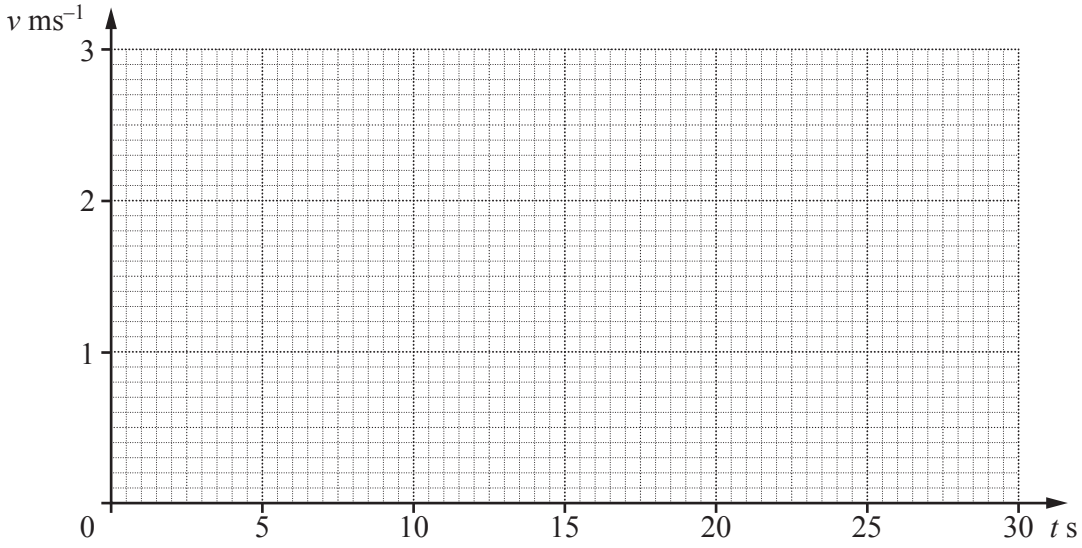



Find the distance travelled by the particle $P$. [2]

**(b)** The diagram shows the displacement-time graph of a particle $Q$ moving in a straight line with displacement $s$ m from a fixed point at time $t$ s.



On the axes below, plot the corresponding velocity-time graph for the particle $Q$. [3]




**(c)** The displacement $s$ m of a particle $R$, which is moving in a straight line, from a fixed point at time $t$ s is given by $s = 4t - 16\ln(t+1) + 13$.

**(i)** Find the value of $t$ for which the particle $R$ is instantaneously at rest. [3]

**(ii)** Find the value of $t$ for which the acceleration of the particle $R$ is $0.25\text{ms}^{-2}$. [2]

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**[Turn over**

**10** **(a)** How many even numbers less than 500 can be formed using the digits 1, 2, 3, 4 and 5? Each digit may be used only once in any number. [4]

**(b)** A committee of 8 people is to be chosen from 7 men and 5 women. Find the number of different committees that could be selected if

**(i)** the committee contains at least 3 men and at least 3 women, [4]

**(ii)** the oldest man or the oldest woman, but not both, must be included in the committee. [2]

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**11** **(a)** Solve $5\sin 2x + 3\cos 2x = 0$ for $0° \leqslant x \leqslant 180°$. [4]

**(b)** Solve $2\cot^2 y + 3\operatorname{cosec} y = 0$ for $0° \leqslant y \leqslant 360°$. [4]

**Question 11(c) is printed on the next page.**

**(c)** Solve $3\cos(z + 1.2) = 2$ for $0 \leqslant z \leqslant 6$ radians. [4]

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