Cambridge IGCSE

**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*1585864014*

**MATHEMATICS** **0580/21**

Paper 2 (Extended) **May/June 2014**

**1 hour 30 minutes**

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Tracing paper (optional)
Geometrical instruments

**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** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For $\pi$, use either your calculator value or 3.142.

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 of the marks for this paper is 70.



The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **12** printed pages.

**1** Use your calculator to work out $\sqrt{\frac{3}{4}} + 2^{-1}$.

Give your answer correct to 2 decimal places.

✱ Calculator display = 1·36602...

≃ 1·37 (2dp)

*Answer* ..... 1·37 ..... [2]

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**2** $y = \frac{2}{x^2} + \frac{x^2}{2}$

Find the value of $y$ when $x = 6$.
Give your answer as a mixed number in its simplest form.

✱ $y = \frac{2}{6^2} + \frac{6^2}{2}$

$\Rightarrow y = \frac{325}{18} = 18\frac{1}{18}$

*Answer* $y$ = ..... $18\frac{1}{18}$ ..... [2]

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**3** Solve the equation.

$\frac{n-8}{2} = 11$

$\Rightarrow n - 8 = 22$

$\Rightarrow n = 22 + 8$

$\Rightarrow n = 30$

*Answer* $n$ = ..... 30 ..... [2]

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**4** $$p = \frac{4.8 \times 1.98276}{16.83}$$

**(a)** In the spaces provided, write each number in this calculation correct to 1 significant figure.

*Answer(a)*

$$\frac{5 \times 2}{30}$$

[1]

**(b)** Use your answer to **part (a)** to estimate the value of $p$.

*Answer(b)* 0·5 [1]

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**5** Write the following in order of size, smallest first.

$0.5^2$ → 0·25 (2) $\quad$ 0.5 → 0·5 (3) $\quad$ $0.5^3$ → 0·125 (1) $\quad$ $\sqrt[3]{0.5}$ → 0·795 (4)

*Answer* $0.5^3$ < $0.5^2$ < 0·5 < $\sqrt[3]{0.5}$ [2]

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**6** Carlo changed 800 euros (€) into dollars for his holiday when the exchange rate was €1 = $1.50 .
His holiday was then cancelled.
He changed all his dollars back into euros and he received €750.

Find the new exchange rate.

€1 = $1·50 $\quad$ €750 = $1200

€800 = x $\quad$ €1 = y

$\Rightarrow x = \frac{€800}{€1} \times \$1{\cdot}50$ $\quad$ $\Rightarrow y = \frac{€1}{€750} \times \$1200$

$\Rightarrow x = \$1200$ $\quad$ $\Rightarrow y = \$1{\cdot}60$

*Answer* €1 = $1·60 [3]

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**7** Make $x$ the subject of the formula.

$$y = (x-4)^2 + 6$$

$\Rightarrow (x-4)^2 = y - 6$

$\Rightarrow x - 4 = \pm\sqrt{y-6}$

$\Rightarrow x = 4 \pm \sqrt{y-6}$ #

*Answer* $x =$ $4 \pm \sqrt{y-6}$ [3]

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**8** Write as a single fraction in its simplest form.

$$\frac{2}{x} - \frac{2}{x+1}$$

$\Rightarrow \dfrac{2(x+1) - 2x}{x(x+1)}$

$\Rightarrow \dfrac{2x + 2 - 2x}{x(x+1)}$

$\Rightarrow \dfrac{2}{x(x+1)}$ #

*Answer* $\dfrac{2}{x(x+1)}$ [3]

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**9** A bus company in Dubai has the following operating times.

| Day | Starting time | Finishing time | |
|---|---|---|---|
| Saturday | 0600 | 2400 | Time duration = 18h |
| Sunday | 0600 | 2400 | Time duration = 18h |
| Monday | 0600 | 2400 | Time duration = 18h |
| Tuesday | 0600 | 2400 | Time duration = 18h |
| Wednesday | 0600 | 2400 | Time duration = 18h |
| Thursday | 0600 | 2400 | Time duration = 18h |
| Friday | 1300 | 2400 | Time duration = 11h |

**(a)** Calculate the total number of hours that the bus company operates in one week.

★ Total no. of hours = $(6 \times 18h) + 11h$

⇒ Total no. of hours = $119h$

*Answer(a)* ..... 119 ..... h [3]

**(b)** Write the starting time on Friday in the 12-hour clock.

*Answer(b)* ..... 1:00 pm ..... [1]

**10** Factorise completely.

**(a)** $ax + ay + bx + by$

$\Rightarrow a(x+y) + b(x+y)$

$\Rightarrow (a+b)(x+y)$

*Answer(a)* $(a+b)(x+y)$ [2]

**(b)** $3(x-1)^2 + (x-1)$

$\Rightarrow (x-1)\left[3(x-1)+1\right]$

$\Rightarrow (x-1)(3x-3+1)$

$\Rightarrow (x-1)(3x-2)$

*Answer(b)* $(x-1)(3x-2)$ [2]

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**11** A triangle has sides of length 2 cm, 8 cm and 9 cm.

Calculate the value of the largest angle in this triangle.

✱ Cosine Rule:

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

$\Rightarrow \hat{A} = \cos^{-1}\left(\frac{a^2-(b^2+c^2)}{-2bc}\right)$

For largest angle, b and c must be the smallest lengths.

$\Rightarrow \hat{A} = \cos^{-1}\left(\frac{9^2-(2^2+8^2)}{-2(2)(8)}\right)$

$\Rightarrow \hat{A} = 114.0°$ (1 dp)

*Answer* $114.0°$ [4]

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**12** $p = 4 \times 10^5$ $q = 5 \times 10^4$

Find, giving your answer in standard form,

**(a)** $pq$,

$\Rightarrow pq = 4 \times 10^5 \times 5 \times 10^4$ $\Rightarrow pq = 2{\cdot}0 \times 10^{10}$

$\Rightarrow pq = (4 \times 5) \times 10^{5+4}$

$\Rightarrow pq = 20 \times 10^9$

*Answer(a)* $2{\cdot}0 \times 10^{10}$ [2]

**(b)** $\frac{q}{p}$.

$\Rightarrow \frac{q}{p} = \frac{5 \times 10^4}{4 \times 10^5}$ $\Rightarrow \frac{q}{p} = 1{\cdot}25 \times 10^{-1}$

$\Rightarrow \frac{q}{p} = \left(\frac{5}{4}\right) \times 10^{4-5}$

*Answer(b)* $1{\cdot}25 \times 10^{-1}$ [2]

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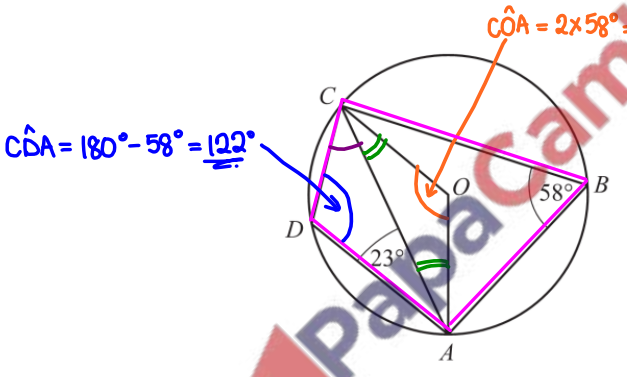
**13**




$C\hat{O}A = 2 \times 58° = 116°$

$C\hat{D}A = 180° - 58° = 122°$

NOT TO SCALE

$A$, $B$, $C$ and $D$ lie on a circle centre $O$.
Angle $ABC = 58°$ and angle $CAD = 23°$.

Calculate

$\star (2 \times O\hat{C}A) + 116° = 180°$

**(a)** angle $OCA$, $\Rightarrow 2 \times O\hat{C}A = 64°$

$\Rightarrow O\hat{C}A = 32°$

*Answer(a)* Angle $OCA$ = $32°$ [2]

**(b)** angle $DCA$. $\star D\hat{C}A + 122° + 23° = 180°$

$\Rightarrow D\hat{C}A + 145° = 180°$

$\Rightarrow D\hat{C}A = 35°$

*Answer(b)* Angle $DCA$ = $35°$ [2]

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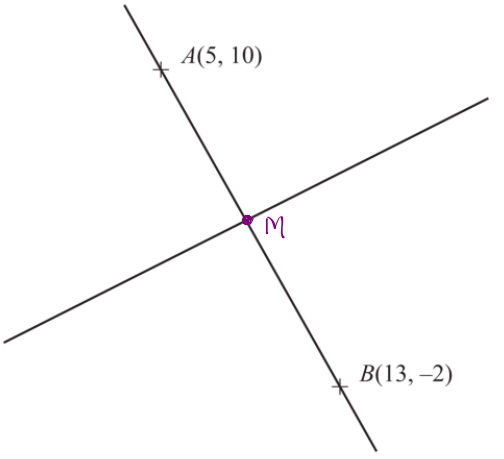
**14**




NOT TO SCALE

$A(5, 10)$ and $B(13, -2)$ are two points on the line $AB$.
The perpendicular bisector of the line $AB$ has gradient $\frac{2}{3}$.

Find the equation of the perpendicular bisector of $AB$.

$\star\ y = mx + c$

- $m = \frac{2}{3}$

$\Rightarrow y = \frac{2}{3}x + c$

- $M\left(\frac{5+13}{2}, \frac{10+(-2)}{2}\right)$

$M(9, 4)$

- Finding c

$\Rightarrow 4 = \frac{2}{3}(9) + c$

$\Rightarrow c = -2$

Hence,

$y = \frac{2}{3}x - 2$

*Answer* $y = \frac{2}{3}x - 2$ [4]

**15** Solve the inequality for positive integer values of $x$.

$$\frac{21+x}{5} > x+1$$

$\Rightarrow 21+x > 5(x+1)$

$\Rightarrow 21+x > 5x+5$

$\Rightarrow 21-5 > 5x-x$

$\Rightarrow 16 > 4x$

$\Rightarrow 4 > x$ OR $x < 4$

For positive integer values of x,

$x = 1, 2, 3$

*Answer* 1, 2, 3 [4]

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**16** **(a)** $(2^{24})^{\frac{1}{2}} = p^4$

Find the value of $p$.

$\Rightarrow p^4 = 2^{24 \times 1/2}$ $\Rightarrow p = (2^{12})^{1/4}$

$\Rightarrow p^4 = 2^{12}$ $\Rightarrow p = 2^3 = 8$

*Answer(a)* $p =$ 8 [2]

**(b)** Simplify $\dfrac{q^2+q^2}{q^{\frac{1}{4}} \times q^{\frac{1}{4}}}$.

$\Rightarrow \dfrac{2q^2}{q^{1/4+1/4}}$ $\Rightarrow 2q^{2-1/2}$

$\Rightarrow \dfrac{2q^2}{q^{1/2}}$ $\Rightarrow 2q^{3/2}$

*Answer(b)* $2q^{3/2}$ [3]

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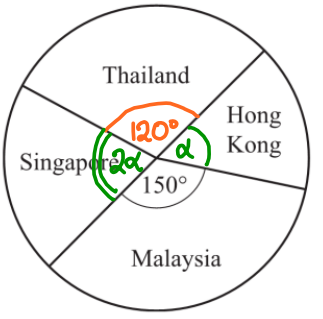
**17**




NOT TO SCALE

A travel brochure has 72 holidays in four different countries.
The pie chart shows this information.

**(a)** There are 24 holidays in Thailand.

Show that the sector angle for Thailand is 120°.

*Answer(a)*

$\star \frac{\theta_T}{360^\circ} \times 72 = 24$

$\Rightarrow \theta_T = \frac{24 \times 360^\circ}{72}$

$\Rightarrow \theta_T = 120^\circ$ [2]

**(b)** The sector angle for Malaysia is 150°.
The sector angle for Singapore is twice the sector angle for Hong Kong.

Calculate the number of holidays in Hong Kong.

$\star\ 2\alpha + \alpha + 120^\circ + 150^\circ = 360^\circ$

$\Rightarrow 3\alpha = 90^\circ$

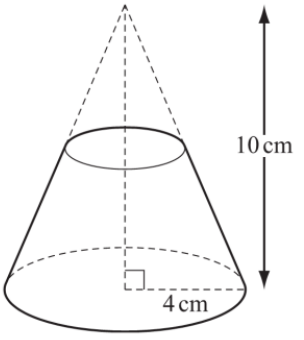
$\Rightarrow \alpha = 30^\circ$

Hence,

$\star$ HK holidays $= \frac{30^\circ}{360^\circ} \times 72 = 6$

*Answer(b)* 6 [3]

**18**




NOT TO SCALE

A **solid** cone has base radius 4 cm and height 10 cm.
A mathematically similar cone is removed from the top as shown in the diagram.
The volume of the cone that is removed is $\frac{1}{8}$ of the volume of the original cone.

**(a)** Explain why the cone that is removed has radius 2 cm and height 5 cm.

*Answer(a)*

Small Big

$\frac{1}{8}V$ $V$

$r^3$ $4^3$

$h^3$ $10^3$

$\bullet \ \frac{r^3}{4^3} = \frac{\frac{1}{8}V}{V}$

$\Rightarrow r = \left(\frac{1}{8} \times 4^3\right)^{\frac{1}{3}} \text{cm} = 2\text{cm}$

$\bullet \ \frac{h^3}{10^3} = \frac{\frac{1}{8}V}{V}$

$\Rightarrow h = \left(\frac{1}{8} \times 10^3\right)^{\frac{1}{3}} \text{cm} = 5\text{cm}$

[2]

**(b)** Calculate the volume of the remaining solid.

[The volume, $V$, of a cone with radius $r$ and height $h$ is $V = \frac{1}{3}\pi r^2 h$.]

$\star \ V_{SOLID} = V_{BIG\ CONE} - V_{SMALL\ CONE}$

$\Rightarrow V_{SOLID} = \frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$

$\Rightarrow V_{SOLID} = \frac{1}{3}\pi \left(R^2 H - r^2 h\right)$

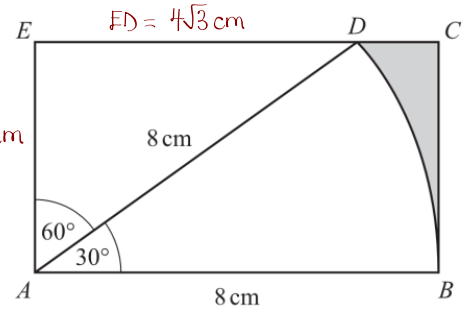
$\Rightarrow V_{SOLID} = \frac{1}{3}\pi \left((4^2 \times 10) - (2^2 \times 5)\right) \text{cm}^3$

$\Rightarrow V_{SOLID} = 147\text{cm}^3$ (3 sig. figs.)

*Answer(b)* 147 ..... $\text{cm}^3$ [4]

**Question 19 is printed on the next page.**

19




NOT TO SCALE

The diagram shows a rectangle *ABCE*.
*D* lies on *EC*.
*DAB* is a sector of a circle radius 8 cm and sector angle 30°.

Calculate the area of the shaded region.

$\star\ A_{SR} = A_{REC} - (A_{TRIANGLE} + A_{SECTOR})$

$\bullet\ A_{REC} = (8 \times 4)\ cm^2$

$\Rightarrow A_{REC} = 32\ cm^2$

$\bullet\ A_{TRIANGLE} = \left(\frac{1}{2} \times 4 \times 4\sqrt{3}\right) cm^2$

$\Rightarrow A_{TRIANGLE} = 8\sqrt{3}\ cm^2$

$\bullet\ A_{SECTOR} = \left(\frac{30^\circ}{360^\circ} \times \pi (8)^2\right) cm^2$

$\Rightarrow A_{SECTOR} = \frac{16\pi}{3}\ cm^2$

Hence,

$A_{SR} = \left[32 - \left(8\sqrt{3} + \frac{16\pi}{3}\right)\right] cm^2$

$\Rightarrow A_{SR} = 1{\cdot}39\ cm^2$ (3 sig. figs.)

*Answer* 1·39 ..... $cm^2$ [7]