Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2015**

1 hour 30 minutes

Candidates answer on the Question Paper.

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

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 π, 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 At noon the temperature was 4 °C.
At midnight the temperature was –5.5 °C.

Work out the difference in temperature between noon and midnight.

$\therefore$ Difference $= 9.5\,^{\circ}C$

$\star\ \Delta T = T_2 - T_1$

$\Rightarrow \Delta T = (-5.5 - 4)\,^{\circ}C = -9.5\,^{\circ}C$

Answer 9.5 °C [1]

---

2 Use your calculator to work out $\sqrt{10 + 0.6 \times (8.3^2 + 5)}$.

$\star$ Calculator display $= 7.3711600\ldots$

$\simeq 7.37$ (3 sig. figs.)

Answer 7.37 [1]

---

3 Write 270 000 in standard form.

$2.7\,0\,0\,0\,0\,0 = 2.7 \times 10^5$ (5 4 3 2 1)

Answer 2.7×10^5 [1]

---

4 Expand and simplify.

$$x(2x + 3) + 5(x - 7)$$

$\Rightarrow 2x^2 + 3x + 5x - 35$

$\Rightarrow 2x^2 + 8x - 35$

Answer $2x^2 + 8x - 35$ [2]

---

5 Paul and Sammy take part in a race.

The probability that Paul wins the race is $\frac{9}{35}$.

The probability that Sammy wins the race is 26%.

Who is more likely to win the race?
Give a reason for your answer.

$\star\ P(\text{Sammy wins}) = 26\%$

$\star\ P(\text{Paul wins}) = \frac{9}{35} \times 100\% = 25.7\%$

Answer Sammy because he has a higher probability score to win the race. [2]

---

6 Rice is sold in 75 gram packs and 120 gram packs. (M_1, M_2)
The masses of both packs are given correct to the nearest gram.

Calculate the lower bound for the difference in mass between the two packs.

$\star$ $LB(M_{diff}) = LB(M_2) - UB(M_1)$

$\Rightarrow LB(M_{diff}) = \left(120 - \frac{1}{2}\right)g - \left(75 + \frac{1}{2}\right)g$

$\Rightarrow LB(M_{diff}) = 119.5g - 75.5g$

$\Rightarrow LB(M_{diff}) = 44g$

Answer ..... 44 ..... g [2]

---

7 Simplify.

$6uw^{-3} \times 4uw^6$

$\Rightarrow (6 \times 4) \times u^{1+1} \times w^{-3+6}$

$\Rightarrow 24u^2w^3$

Answer ..... $24u^2w^3$ ..... [2]

---

8 The point A has co-ordinates $(-4, 6)$ and the point B has co-ordinates $(7, -2)$.

Calculate the length of the line AB.

$\star$ $L = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$\star$ $L = \sqrt{(-4 - 7)^2 + (6 - (-2)^2}$

$\Rightarrow L = 13.6$ (3 sig. figs.)

Answer $AB =$ ..... 13.6 ..... units [3]

---

9 **Without using a calculator**, work out $1\frac{4}{5} \div \frac{3}{7}$.

Show all your working and give your answer as a fraction in its lowest terms.

$\star$ $1\frac{4}{5} \div \frac{3}{7}$

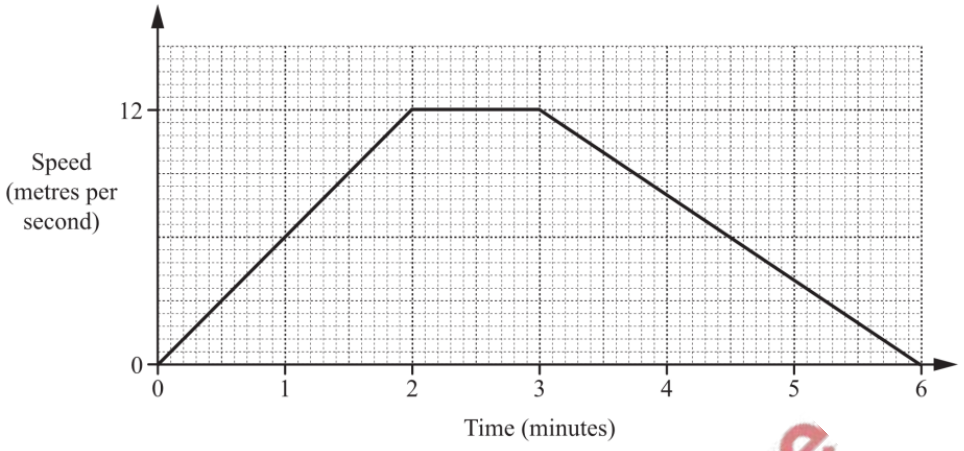
$\Rightarrow \frac{9}{5} \div \frac{3}{7}$

$\Rightarrow \frac{9}{5} \times \frac{7}{3}$

$\Rightarrow \frac{21}{5}$ OR $4\frac{1}{5}$

Answer ..... $4\frac{1}{5}$ ..... [3]

10



A tram leaves a station and accelerates for 2 **minutes** until it reaches a speed of 12 metres per second.
It continues at this speed for 1 minute.
It then decelerates for 3 minutes until it stops at the next station.
The diagram shows the speed-time graph for this journey.

Calculate the distance, in metres, between the two stations.

✱ Distance travelled = Area under the graph = $\frac{1}{2}(a+b)\times h$

• $h = 12$ m/s • $a = 1$ min $= 60$ s • $b = 6$ mins $= 360$ s

⇒ Distance travelled $= \left[\frac{1}{2}(60+360)\times 12\right]$ m

⇒ Distance travelled = 2520 m

Answer ..... 2520 ..... m [3]

---

11 Find the *n*th term of each sequence.

(a) 4, 8, 12, 16, 20, ...

(+4, +4, +4, +4)

✱ $a_n = a_1 + (n-1)d$

⇒ $a_n = 4 + (n-1)4$

⇒ $a_n = 4 + 4n - 4 = 4n$

Answer(a) ..... 4n ..... [1]

(b) 11, 20, 35, 56, 83, ...

$a+b+c =$ 11, 20, 35, 56, 83

$3a+b =$ +9, +15, +21, +27

$2a =$ +6, +6, +6

✱ $2a = 6$ ⇒ $a = 3$

✱ $(3\times 3) + b = 9$ ⇒ $b = 0$

✱ $3 + 0 + c = 11$ ⇒ $c = 8$

✱ $a_n = an^2 + bn + c$

Hence,

⇒ $a_n = 3n^2 + 8$

Answer(b) ..... $3n^2 + 8$ ..... [2]

---

12 p is inversely proportional to the square of $(q + 4)$.
$p = 2$ when $q = 2$.

Find the value of p when $q = -2$.

$\star\ p \propto \frac{1}{(q+4)^2}$ $\Rightarrow p = \frac{72}{(q+4)^2}$

$\Rightarrow p = \frac{k}{(q+4)^2}$

• when $q = -2$,

$\Rightarrow p = \frac{72}{(-2+4)^2} = 18$

• Finding k

when $p = 2$, $q = 2$

$\Rightarrow k = 2(2+4)^2 = 72$

Answer $p =$ 18 [3]

---

13 A car travels a distance of 1280 **metres** at an average speed of 64 kilometres per hour.

Calculate the time it takes for the car to travel this distance.
Give your answer in **seconds**.

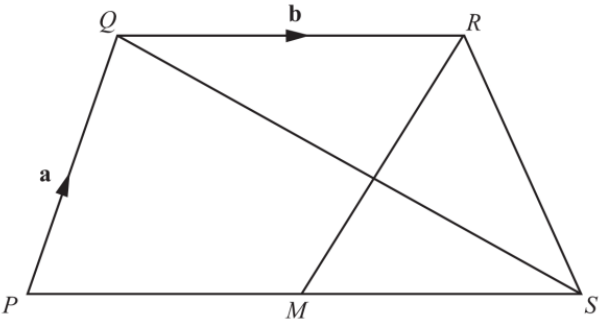
$\star\ t = \frac{D}{V}$

$\Rightarrow t = \frac{1280 \times 10^{-3}\ \text{km}}{\frac{64\ \text{km}}{3600\text{s}}}$

$\Rightarrow t = 72\text{s}$

Answer 72 s [3]

14



NOT TO SCALE

$PQRS$ is a quadrilateral and M is the midpoint of PS.
$\overrightarrow{PQ} = \mathbf{a}$, $\overrightarrow{QR} = \mathbf{b}$ and $\overrightarrow{SQ} = \mathbf{a} - 2\mathbf{b}$.

(a) Show that $\overrightarrow{PS} = 2\mathbf{b}$.

Answer(a)

$\overrightarrow{PS} = \overrightarrow{PQ} + \overrightarrow{QS}$

$\Rightarrow \overrightarrow{PS} = a + 2b - a$

$\Rightarrow \overrightarrow{PS} = 2b$

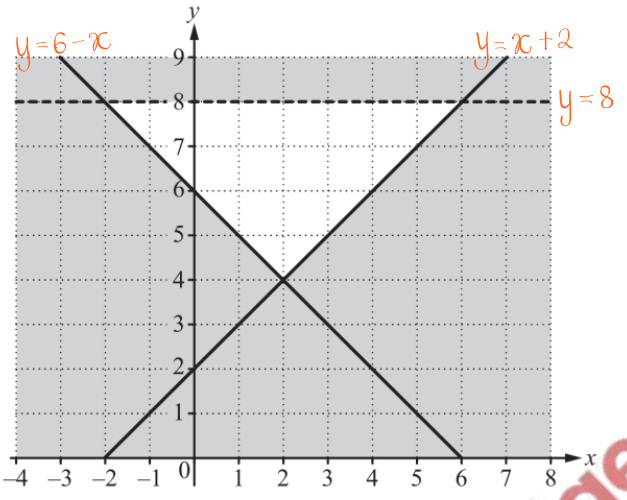
[1]

(b) Write down the mathematical name for the quadrilateral $PQRM$, giving reasons for your answer.

Answer(b) Parallelogram because QR is equal and parallel to PM.

[2]

15



Write down the 3 inequalities which define the unshaded region.

Answer $y \leq 8$

$y \geq x + 2$

$y \geq 6 - x$ [4]

---

16 Georg invests \$5000 for 14 years at a rate of 2% per year compound interest.

Calculate the interest he receives.
Give your answer correct to the nearest dollar.

★ Interest = A − P

• Finding A

$A = \$5000\left(1 + \frac{2}{100}\right)^{14}$

$A = \$6597.39$ (2dp)

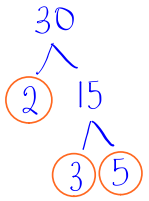
$\therefore$ Interest = \$(6597.39 − 5000)

$\Rightarrow$ Interest = \$1597 (nearest dollar)

Answer \$ 1597 [4]

---

17 **(a)** Write 30 as a product of its prime factors.



$30 = 2 \times 3 \times 5$

Answer(a) ..... $2 \times 3 \times 5$ ..... [2]

(b) Find the lowest common multiple (LCM) of 30 and 45.

$30 \rightarrow 30, 60, 90, 120, \ldots$

$45 \rightarrow 45, 90, \ldots$

Answer(b) ..... 90 ..... [2]

---

18 Solve the simultaneous equations.
You must show all your working.

$5x + 2y = -2$ – (1)
$3x - 5y = 17.4$ – (2)

(1) $\times 5$: $25x + 10y = -10$ – (3)
(2) $\times 2$: $6x - 10y = 34.8$ – (4)

(3) + (4): $31x = 24.8$

$\Rightarrow x = \frac{24.8}{31}$

$\Rightarrow x = 0.8$

• Finding y:

$5(0.8) + 2y = -2$

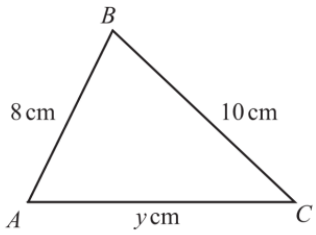
$\Rightarrow 2y = -6$

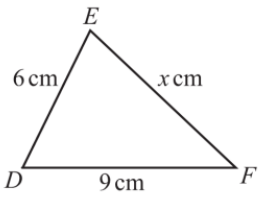
$\Rightarrow y = -3$

Answer x = ... 0.8 .....

y = ... -3 ..... [4]

19





NOT TO SCALE

Triangle ABC is similar to triangle DEF.

Calculate the value of

(a) x,

$\frac{x}{10\text{cm}} = \frac{6\text{cm}}{8\text{cm}}$

$\Rightarrow x = \left(\frac{6}{8} \times 10\right)\text{cm} = 7.5\text{ cm}$

Answer(a) $x =$ 7.5 [2]

(b) y.

$\frac{y}{9\text{cm}} = \frac{8\text{cm}}{6\text{cm}}$

$\Rightarrow y = \left(\frac{8}{6} \times 9\right)\text{cm} = 12\text{cm}$

Answer(b) $y =$ 12 [2]

---

20 Factorise completely.

(a) $yp + yt + 2xp + 2xt$

$\Rightarrow y(p+t) + 2x(p+t)$

$\Rightarrow (y+2x)(p+t)$

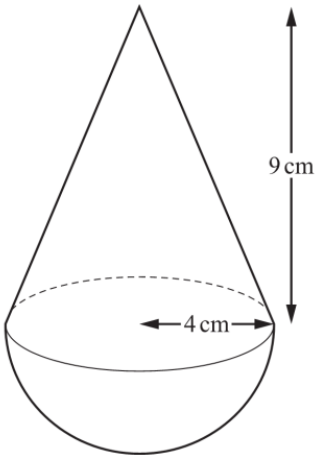
Answer(a) $(y+2x)(p+t)$ [2]

(b) $7(h+k)^2 - 21(h+k)$

$\Rightarrow 7(h+k)(h+k-3)$

Answer(b) $7(h+k)(h+k-3)$ [2]

21



NOT TO SCALE

The diagram shows a toy.
The shape of the toy is a cone, with radius 4 cm and height 9 cm, on top of a hemisphere with radius 4 cm.

Calculate the volume of the toy.
Give your answer correct to the nearest cubic centimetre.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]
[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$\star\ V_{toy} = V_{cone} + V_{hemisphere}$

$\Rightarrow V_{toy} = \frac{1}{3}\pi r^2 h + \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$

$\Rightarrow V_{toy} = \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3$

$\Rightarrow V_{toy} = \left(\frac{1}{3}\pi(4)^2(9)\right)cm^3 + \left(\frac{2}{3}\pi(4)^3\right)cm^3$

$\Rightarrow V_{toy} = \frac{272\pi}{3}cm^3 \simeq 285cm^3$ (nearest cubic centimetre)

Answer ..... 285 ..... cm^3 [4]

22 **(a)** Calculate $\begin{pmatrix} 3 & 7 \\ -1 & 4 \end{pmatrix}\begin{pmatrix} -2 & 1 \\ 4 & 2 \end{pmatrix}$.

$\Rightarrow \begin{pmatrix} (3\times -2)+(7\times 4) & (3\times 1)+(7\times 2) \\ (-1\times -2)+(4\times 4) & (-1\times 1)+(4\times 2) \end{pmatrix}$

$\Rightarrow \begin{pmatrix} 22 & 17 \\ 18 & 7 \end{pmatrix}$

Answer(a) $\begin{pmatrix} 22 & 17 \\ 18 & 7 \end{pmatrix}$ [2]

(b) Calculate the inverse of $\begin{pmatrix} 5 & 3 \\ 6 & 4 \end{pmatrix}$.

Let $A = \begin{pmatrix} 5 & 3 \\ 6 & 4 \end{pmatrix}$

$\Rightarrow A^{-1} = \frac{1}{\det A}\begin{pmatrix} 4 & -3 \\ -6 & 5 \end{pmatrix}$

- $\det A = (5\times 4)-(3\times 6) = 2$

Hence,

$A^{-1} = \frac{1}{2}\begin{pmatrix} 4 & -3 \\ -6 & 5 \end{pmatrix}$

Answer(b) $\frac{1}{2}\begin{pmatrix} 4 & -3 \\ -6 & 5 \end{pmatrix}$ [2]

Question 23 is printed on the next page.

23 $f(x) = 5 - 3x$

(a) Find f(6).

$f(6) = 5 - 3(6)$

$\Rightarrow f(6) = -13$

Answer(a) ..... -13 ..... [1]

(b) Find $f(x + 2)$.

$f(x+2) = 5 - 3(x+2)$

$\Rightarrow f(x+2) = 5 - 3x - 6$

$\Rightarrow f(x+2) = -3x - 1$

Answer(b) ..... $-3x - 1$ ..... [1]

(c) Find $ff(x)$, in its simplest form.

$ff(x) = 5 - 3(5 - 3x)$

$\Rightarrow ff(x) = 5 - 15 + 9x$

$\Rightarrow ff(x) = 9x - 10$

Answer(c) ..... $9x - 10$ ..... [2]

(d) Find $f^{-1}(x)$, the inverse of $f(x)$.

$f(x) = 5 - 3x$

$\Rightarrow x = 5 - 3y$

$\Rightarrow 3y = 5 - x$

$\Rightarrow y = \frac{5-x}{3}$

$\therefore f^{-1}(x) = \frac{5-x}{3}$

Answer(d) $f^{-1}(x) =$ ..... $\frac{5-x}{3}$ ..... [2]