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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2019**

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 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.

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

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[Turn over

1 Write down a prime number between 50 and 60.

53 OR 59 ..... [1]

2 Use your calculator to work out $\sqrt{1-(\sin 33°)^2}$.

0·8386 OR 0·839 OR 0·8387 ..... [1]

3 Write the recurring decimal $0.\dot{7}$ as a fraction.

$x = 0.777\ldots$
$10x = 7.777\ldots$
$10x - x = 7$

$9x = 7$
$x = \frac{7}{9}$

$\frac{7}{9}$ ..... [1]

4 Complete each statement.

(a) A quadrilateral with only one pair of parallel sides is called a Trapezium [1]

(b) An angle greater than 90° but less than 180° is called Obtuse . [1]

5 The distance between Prague and Vienna is 254 kilometres.
The local time in Prague is the same as the local time in Vienna.
A train leaves Prague at 15 20 and arrives in Vienna at 19 50 the same day.

Calculate the average speed of the train.

Average speed = Total distance ÷ Total time
Total distance = 254 km
Total time = 4·5 hours

15·20 → 19:20 → 19:50
4 hours 30 mins = (0·5h)

Average speed = $\frac{254}{4.5}$
= 56·44...

56·4 ..... km/h [2]

6 Solve the equation.

$9f + 11 = 3f + 23$

$9f + 11 = 3f + 23$
$9f - 3f = 23 - 11$
$6f = 12$

$f = 12 \div 6$
$f = 2$

$f =$ 2 ..... [2]

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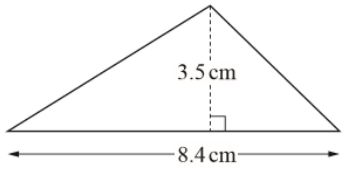

NOT TO SCALE

Calculate the area of this triangle.

Area of a triangle $= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 8.4 \times 3.5$

$= 14.7$

14.7 ..... cm^2 [2]

8 **(a)** Write 0.047 883 correct to 2 significant figures.

0.048 ..... [1]

(b) Write 0.005 27 in standard form.

5.27×10^{-3} ..... [1]

9 Find the highest common factor (HCF) of 90 and 48.

2	90	48
3	45	24
	15	8

Factors of 90 = 2, 3,

Factors of 4 = 2, 3,

Common Factors = 2, 3

Highest Common Factor = $2 \times 3 = 6$

6 ..... [2]

10 On a map with scale 1 : 25 000, the area of a lake is 33.6 square centimetres.

Calculate the actual area of the lake, giving your answer in square kilometres.

Scale: 1 cm = 25000 cm

$1\,cm^2 = 25000 \times 25000\,cm^2$

$\therefore 1\,cm^2 = 6.25 \times 10^8\,cm^2$

$\therefore$ Actual area of lake $= 6.25 \times 10^8 \times 33.6$

$= 210 \times 10^8$

$= 2.1 \times 10^{10}\,cm^2$

$1\,km = 100000\,cm$

$1\,km^2 = 10000000000\,cm^2$

$\therefore 1\,km^2 = 10^{10}\,cm^2$

$\therefore x\,km^2 = 2.1 \times 10^{10}\,cm^2$

$x = [2.1 \times 10^{10}] \div 10^{10}$

$\therefore x = 2.1\,km^2$

2.1 ..... km^2 [2]

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11 Write down the matrix that represents an enlargement, scale factor 3, centre (0, 0).

OUT OF SYLLABUS

$\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$ [2]

12 Simplify.

(a) $5m^2 \times 2m^3$

$5m^2 \times 2m^3 = 5 \times 2 \times m^3 \times m^2 = 10m^5$

$10m^5$ [2]

(b) $(x^8)^3$

$x^{8 \times 3} = x^{24}$

x^{24} [1]

13 **Without using a calculator**, work out $2\frac{1}{4} \div \frac{3}{7}$.

You must show all your working and give your answer as a mixed number in its simplest form.

$2\frac{1}{4} \div \frac{3}{7}$

$= \frac{9}{4} \div \frac{3}{7}$

$= \frac{9}{4} \times \frac{7}{3}$

$= \frac{21}{4}$

$= 5\frac{1}{4}$

Note: $2\frac{1}{4} = \frac{4 \times 2 + 1}{4} = \frac{9}{4}$

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

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

$$5x+8y=4$$
$$\tfrac{1}{2}x+3y=7$$

Note: $\frac{1}{2}x+3y=7$ → $x+6y=14$ ⋯→

$5x+8y=4$ → (1)

$5[x+6y=14]$ → (2)

∴ Equation (2) can be written as: $5x+30y=60$

$5x+8y=4$

$-(5x+30y=70)$

$-22y=66$

$\therefore y=66\div22$

$\therefore y=3$

$x=$ -4

$y=$ 3 [3]

15 Shona buys a chair in a sale for \$435.60 .
This is a reduction of 12% on the original price.

Calculate the original price of the chair.

Let the original price = \$x

The selling price = \$435.60

Original price is reduced by 12%.

∴ The equation is:

$x-\frac{12}{100}(x)=435.60$

$100x-12x=43560$

$88x=43560$

$x=43560\div88$

$x=495$

\$ 495 [3]

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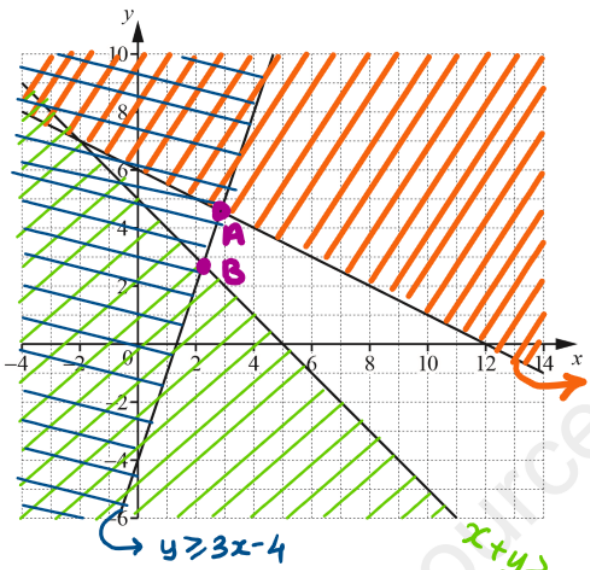

$y \leqslant -\frac{1}{2}x+6$ $\quad y \geqslant 3x-4$ $\quad x+y \geqslant 5$

(a) By shading the **unwanted** regions of the grid, find and label the region R that satisfies the three inequalities. [2]

(b) Find the largest value of $x+y$ in the region R, where x and y are integers.

A (3, 4·5)
B (2·5, 2·5)

∴ Highest value of $x+y = 3+4\cdot5 = 7\cdot5$
∴ Integer value = 7

7 ..... [1]

17 Write as a single fraction in its simplest form.

$$\frac{2x}{x+3}+\frac{x+3}{x-5}$$

$$\frac{2x}{x+3}+\frac{x+3}{x-5}$$

$$\frac{2x(x-5)+(x+3)(x+3)}{(x+3)(x-5)}$$

$$\frac{2x^2-10x+x^2+3x+3x+9}{(x+3)(x-5)}$$

$$\frac{2x^2+x^2-10x+6x+9}{(x+3)(x-5)}$$

$$=[3x^2-4x+9]\div(x+3)(x-5)$$

$$\frac{3x^2-4x+9}{(x+3)(x-5)}$$ ..... [3]

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18 The table shows the number of people in different age groups at a cinema.

Class Width: 10 | 5 | 20 | 30

Age (y years)	$15 < y \leqslant 25$	$25 < y \leqslant 30$	$30 < y \leqslant 50$	$50 < y \leqslant 80$
Number of people	35	32	44	12

Dexter draws a histogram to show this information.
The height of the bar he draws for the group $15 < y \leqslant 25$ is 7 cm.

Calculate the height of each of the remaining bars.

(F.D) Frequency density = Frequency ÷ Class Width
F.D. is the height of a histogram

The heights for histogram should be:
$15 < y \leq 25 = 35 \div 10 = 3.5$
$25 < y \leq 30 = 32 \div 5 = 6.4$
$30 < y \leq 50 = 44 \div 20 = 2.2$
$50 < y \leq 80 = 12 \div 30 = 0.4$

Hence: If instead of 3.5, if the height is drawn as 7, then it means the height is magnified by 2

∴ New heights for the following intervals is as follows:
$25 < y \leq 30 = 6.4 \times 2 = 12.8$
$30 < y \leq 50 = 2.2 \times 2 = 4.4$
$50 < y \leq 80 = 0.4 \times 2 = 0.8$

$25 < y \leqslant 30$ ..... 12.8 ..... cm
$30 < y \leqslant 50$ ..... 4.4 ..... cm
$50 < y \leqslant 80$ ..... 0.8 ..... cm [3]

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19 Rearrange this formula to make m the subject.

$$P = \frac{k+m}{m}$$

$p = \frac{k+m}{m}$

$\therefore pm = k+m$

$\therefore pm - m = k$

$\therefore m(p-1) = k$

$\therefore m = k \div (p-1)$

$\frac{k}{p-1}$ ..... [4]

20 Solve the equation $3x^2 - 2x - 10 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$3x^2 - 2x - 10 = 0$

This equation cannot be factorised normally, hence we make use of the quadratic formula.

Comparing $3x^2 - 2x - 10$ with the ideal quadratic equation $ax^2 + bx + c$ we get $a = 3$; $b = -2$; $c = -10$

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

$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-2)}}{2(3)}$

$x =$ **-1.52** or $x =$ **2.19** [4]

$\therefore$ Plugging in the values in the calculator we get:

$x = -1.52$ or $x = 2.19$

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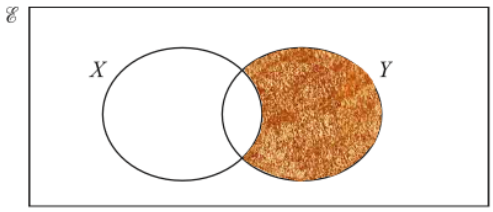
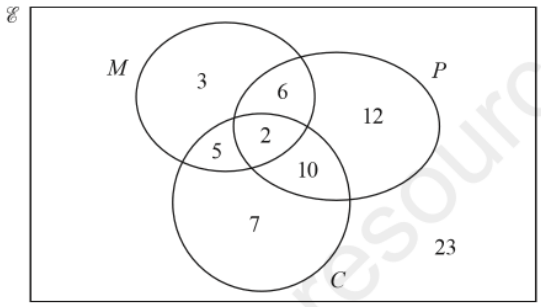
21 **(a)** In the Venn diagram, shade $X' \cap Y$.



[1]

(b) The Venn diagram below shows information about the number of gardeners who grow melons (M), potatoes (P) and carrots (C).



(i) A gardener is chosen at random from the gardeners who grow melons.

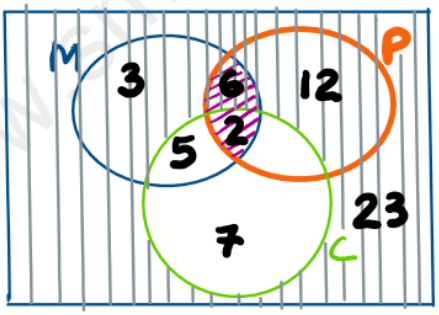
Find the probability that this gardener does not grow carrots.

Total melon growers = 16
Only melon growers = 3
Melon + Potato growers = 6

∴ [6+3] ÷ 16 do not grow carrots

$\frac{9}{16}$ [2]

(ii) Find $n((M \cap P) \cup C')$.



////→ (M∩P)
||||→ C'

46 [1]

Add all the numbers in the shaded region:

3 + 6 + 2 + 12 + 23 = 46

Note: You count the shaded region only because for union you always count everything that is shaded

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22 $\mathbf{A} = \begin{pmatrix} 2 & 7 \\ 1 & 3 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 3 & 4 \\ 0 & 1 \end{pmatrix}$

(a) Calculate **AB**.

NOT IN SYLLABUS

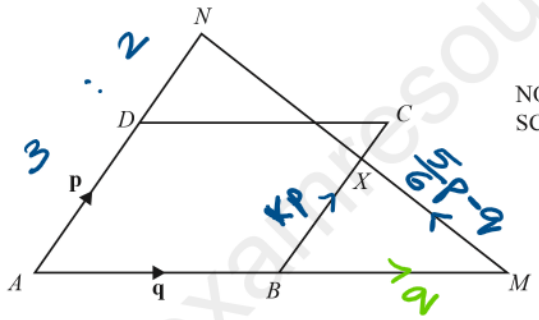
( ) [2]

(b) Find $\mathbf{A}^{-1}$, the inverse of **A**.

NOT IN SYLLABUS

( ) [2]

23



$ABCD$ is a parallelogram with $\overrightarrow{AB} = \mathbf{q}$ and $\overrightarrow{AD} = \mathbf{p}$.
ABM is a straight line with $AB : BM = 1 : 1$.
ADN is a straight line with $AD : DN = 3 : 2$.

(a) Write $\overrightarrow{MN}$, in terms of **p** and **q**, in its simplest form.

$\therefore \overrightarrow{MN} = \overrightarrow{MA} + \overrightarrow{AN}$
$= -2\mathbf{q} + \frac{5}{3}\mathbf{p}$

$\overrightarrow{MN} =$ $\frac{5}{3}\mathbf{p} - 2\mathbf{q}$ [2]

(b) The straight line NM cuts BC at X.
X is the midpoint of MN.
$\overrightarrow{BX} = k\mathbf{p}$

Find the value of k.

$\overrightarrow{MX} = \frac{1}{2}\overrightarrow{MN}$
$= \frac{1}{2}\left[\frac{5}{3}\mathbf{p} - 2\mathbf{q}\right]$

$\overrightarrow{MX} = \frac{5}{6}\mathbf{p} - \mathbf{q}$
$\overrightarrow{BX} = \overrightarrow{BM} + \overrightarrow{MX}$
$k\mathbf{p} = \mathbf{q} + \frac{5}{6}\mathbf{p} - \mathbf{q}$
$k\mathbf{p} = \frac{5}{6}\mathbf{p}$

$k\mathbf{p} = \frac{5}{6}\mathbf{p}$
$\therefore k = \frac{5}{6}$

$\frac{5}{6}$

$k =$ $\frac{5}{6}$ [2]

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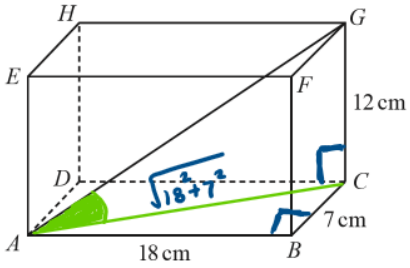

NOT TO SCALE

ABCDEFGH is a cuboid.
$AB = 18$ cm, $BC = 7$ cm and $CG = 12$ cm.

Calculate the angle that the diagonal AG makes with the base $ABCD$.

$AC = \sqrt{18^2+7^2}$

$\tan A = \frac{CG}{AC}$

$\tan A = \frac{12}{\sqrt{18^2+7^2}}$

$A = \tan^{-1} \frac{12}{\sqrt{18^2+7^2}}$

$A = 31.854 = 31.9$

31.9 ..... [4]

Question 25 is printed on the next page.

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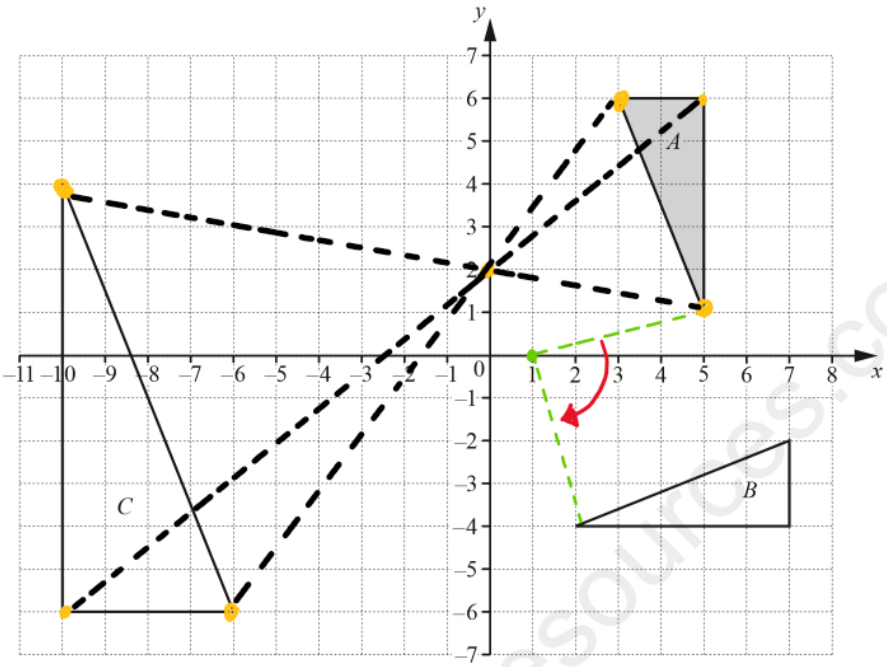

Describe fully the **single** transformation that maps

(a) triangle A onto triangle B,

Rotation, 90° Clockwise, centre of rotation (1,0) [3]

(b) triangle A onto triangle C.

Enlargement, Scale Factor: -2, Centre of enlargement (0,2) [3]

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