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Centre Number

Candidate Number

Further Mathematics Practice Paper A

Further Tier

Thursday 25 May 2017 – Morning
Time: 2 hours 30 minutes

Paper Reference
1MA1/1U

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may not be used.**

Information

- The total mark for this paper is 145
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Q1 a Simplify $\frac{4x^2-9}{x+1} \div \frac{2x=3}{x^2-1}$

(4)

b Simplify $\frac{x}{x^2-1} - \frac{2}{x+1}$

(4)

c Simplify $\frac{5(2c+1)}{3c} + \frac{3(2c-1)}{5c}$

(4)

Q2   Write $\dfrac{8+\sqrt{7}}{3-2\sqrt{7}} + \dfrac{5}{\sqrt{7}}$ in its simplest form.

(5)

Q3   Divide $2x^3 + 3x^2 - 4x + 2$ by (x+1)

(4)

Q4   Divide $90x^4 - 249x^3 + 52x^2 + 109x - 42$ by (3x-7)

(5)

Q5   Solve $3x^2 + 8x = 3$ by factorising.

(3)

Q6 Solve $5x^2 - 10x + 1 = 0$ by completing the square.

(4)

Q7 Solve $x(2x - 5) = 7$ giving your solution correct to three decimal places.

(5)

Q8   In a triangle, the largest angle is 5 times as large as the smallest. The remaining angle is 40°.
Find the size of each angle.

(3)

Q9   A square has sides that are 3x metres long. An oblong has a length of 5x metres and a width
of 4 metres. The perimeters of both shapes are the same. Which shape has the greater area
and by how much?

(3)

Q10 The difference between two positive numbers is 7. The difference between their squares is 161. Taking n to be the smaller of the two numbers, form an equation and solve it.

(3)

Q11 $y = x^2 + 2x$
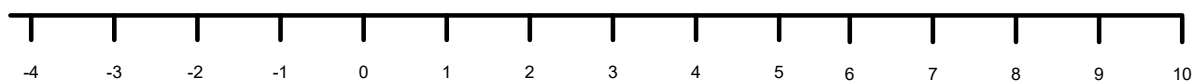
$5x + y = 7$

Find the values of x and y.

(3)

Q12 A circle has the equation $x^2 + y^2 = 81$. A line has the equation $x + 2y = 5$. At what co-ordinates do the circle and the line intercept?

…………………………………..

(4)

Q13 Solve $\frac{6-4x}{2} \leq 7$ and draw the inequality on the number line below.

…………………………………

(3)

Q14   Solve the inequality $3x^2 + 2x - 1 > 0$.

....

(3)

Q15   Write down the first 7 terms of the recurrence sequence defined below.

$$x_{n+2} = 3x_n + 2x_{n+1}^2 \text{ where } x_1 = 2 \text{ and } x_2 = -3$$

....

(5)

Q16 In 2020, the population on an island was 60. A mathematical model predicting the population in future years was given by $x_{n+1} = 1.09x_n$. What is the predicted population in 2035?

………………………………..

(4)

Q17 On a map of scale 1:50 000, two points were marked at the co-ordinates 327938 and 401735. What is the distance between these two points on the ground?

……………………………………

(3)

Q18 Point P(-3,9) and Point Q(4,2) are two points on a graph.

      a) What is the midpoint of this line segment?
      b) What is the equation of this line?
      c) Where does this line intersect a circle with the equation $x^2 + y^2 = 25$?

a ……………………………………………………………….

b ……………………………………………………………..

c ……………………………………………………………..

(8)

Q19   A circle with centre point (3,-2) passes through the point (4,9).

a   Find the area of the circle.
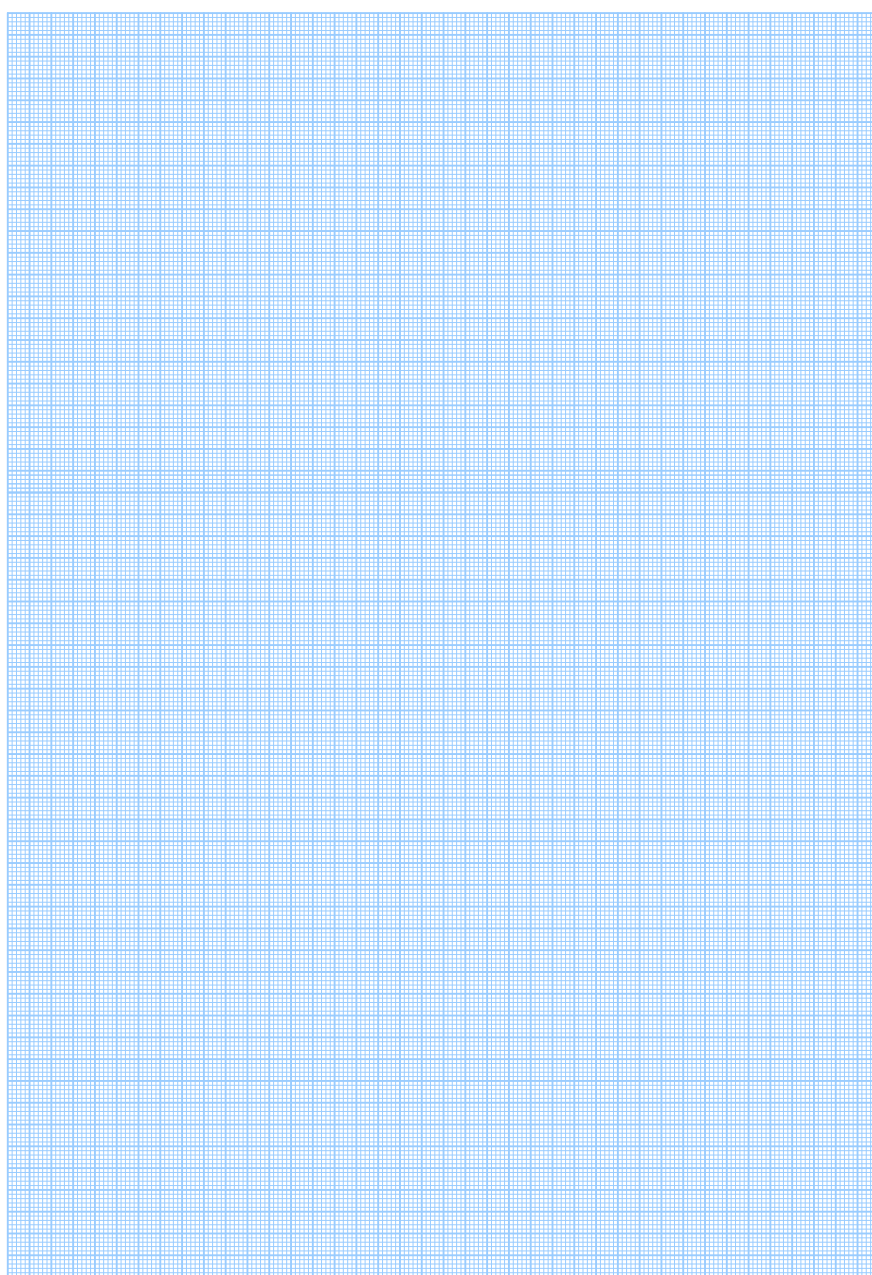
………………………………………

(5)

b   Find the equation of the circle.
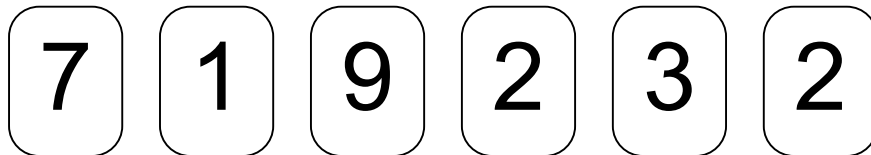
………………………………..

(3)

Q20   Plot the graph $y = 7 + 3x + x^2 - x^3$ for $-3 \le x \le 3$.

(5)

Q21 Two fair dice are rolled. Draw a sample space diagram showing the absolute difference between each die.

(4)

Q22 Six cards are shown below.

7 1 9 2 3 2

a Using each of the cards only once, how many different five digit numbers can be made?

……………………..

(1)

b How many six digit numbers can be made that are greater than 500,000?

……………………..

(2)

c How many four digit numbers can be made?

……………………..

(1)

d How many three digit odd numbers can be made?

……………………..

(2)

Q23   Expand $(p + q)^7$.

(3)

Q24   A company produce millions of batteries per year and is aware that about 1 in 40 of them are defective.

A sample of eight batteries is chosen.

What are the chances that none of them are defective?

…………………………..

(3)

Q25   Solve the equation $7^x = 45000$

……………………………

(3)

Q26 Solve the equation $9 + 8^{2x} = 845$

………………………………..

(4)

Q27 For the iterative sequence, $x_{n+1} = \frac{x_n}{3} - 12$, describe what happens with the starting points detailed below by finding x_1, x_2, x_3 and x_4 for each sequence.

a $\quad x_0 = 12$

b $\quad x_0 = 46$

(6)

Q28 $y = \frac{1}{12}x^4 + 3x^2 + 4$

Calculate the positive value for x for which $\frac{d^2y}{dx^2} = 55$.

………………………………..

(3)

Q29 Work out the value of t and u in the question below.

$$\begin{pmatrix} 3 & 5 \\ u & 2 \end{pmatrix}\begin{pmatrix} 1 \\ 4 \end{pmatrix} = \begin{pmatrix} t \\ 6 \end{pmatrix}$$

u = …………………….….. t = ……………………………………

(2)

Q30 The equation of a circle is $(x + 7)^2 + (y - 4)^2 = 36$

Complete the following statements.

The co-ordinates at the centre of the circle are ………………………. .

The radius of the circle is ………………………. .

(2)

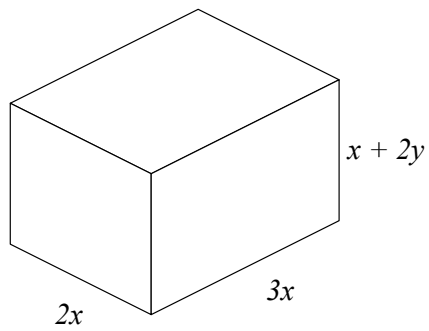**Q31** ABC is a triangle with a perpendicular height AD.
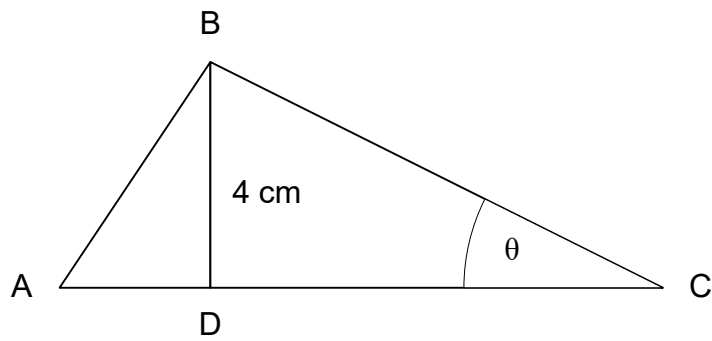
The area of triangle ABC is 25 cm^2.

AD:DC is 2:3

Work out the size of angle θ.

……………………………….

(4)

Q32   The diagram shows a cuboid whose dimensions are given in cm.

The total length of each edge added together is 300 cm.

a Show that $y = \frac{75-6x}{2}$

(2)

b   The volume of the cuboid is V cm.

Show that $V = 450x^2 - 30x^3$

(2)

c   Use calculus to work out the maximum value of V as x varies.

…………………………………

(4)

Q33 $(2x - 3)$ is a factor of $6x^3 - 25x^2 + 28x - 6$.

Solve $6x^3 - 25x^2 + 28x - 6 = 0$

Give all solutions as **<u>exact</u>** values.

…………………………………………..

(4)