AQA Level 2 Certificate in FURTHER MATHEMATICS (8365/2)
Paper 2

Specimen 2020                Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- mathematical instruments

You may use a calculator

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the bottom of this page.
- Answer all questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.

SPECIMEN MATERIAL

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There are no questions printed on this page
Answer all questions in the spaces provided.

1. A sketch of the lines $y = 2x$ and $y = 6$ is shown.

   Work out the area of triangle $OPQ$.

   [3 marks]

   Answer: __________ units$^2$

2. A circle, centre (0, 0) has circumference $20\pi$

   Work out the equation of the circle.

   [2 marks]

   Answer: ________________________________
$M$ is the midpoint of the line $AB$.

Work out the values of $p$ and $r$.  

$p = \quad \quad \quad \quad r = \quad \quad \quad \quad$ 

4 (a) Circle the solution of $-3x < -18$  

$x > -6 \quad \quad \quad x < -6 \quad \quad \quad x > 6 \quad \quad \quad x < 6$ 

4 (b) Circle the solution of $x^2 \geq 16$  

$x \geq -4 \quad \text{or} \quad x \leq 4 \quad \quad \quad x \leq -4 \quad \text{or} \quad x \geq 4$ 

$x \geq -4 \quad \text{or} \quad x \geq 4 \quad \quad \quad x \leq -4 \quad \text{or} \quad x \leq 4$
5 Here is a sketch of \( y = f(x) \) where \( f(x) \) is a quadratic function.

The graph intersects the \( x \)-axis at \( A (-1, 0) \) and \( B \) has a maximum point at \( (0.5, 6) \).

5 (a) Work out the coordinates of \( B \).

\[ \text{Answer} \ (\quad , \quad) \]

5 (b) The equation \( f(x) = k \) has exactly one solution.

Write down the value of \( k \).

\[ \text{Answer} \quad \]

Turn over
6 \[ A = \begin{pmatrix} 4 & -1 \\ -7 & 2 \end{pmatrix}, \quad B = \begin{pmatrix} s \\ -5 \end{pmatrix}, \quad C = \begin{pmatrix} -1 \\ t \end{pmatrix}, \quad D = \begin{pmatrix} 2 & 1 \\ 7 & u \end{pmatrix} \]

\(s, t\) and \(u\) are constants.

6 (a) \[ AB = C \]

Work out the values of \(s\) and \(t\).

[3 marks]

\[ s = \] 

\[ t = \]
6 (b) \quad AD = 1

Work out the value of \( u \). [1 mark]

\[ u = \]

7  \quad Work out the equation of the straight line that is
parallel to the line \( 2y = x \)
and
intersects the \( x \)-axis at (4, 0) [3 marks]

Answer ________________________________
8 (a) Work out \( \frac{ab}{cd} + \frac{bc}{ad} \)

Give your answer as a single fraction in its simplest form. [2 marks]

Answer

8 (b) Work out \( \frac{7}{2x^2} + \frac{4}{3x} \)

Give your answer as a single fraction in its simplest form. [2 marks]

Answer
A, B and C are points on a circle, centre O.

Work out the size of angle $y$.

Answer: __________ degrees
\[ y = \frac{6x^9 + x^8}{2x^4} \]

Work out the value of \( \frac{d^2y}{dx^2} \) when \( x = 0.5 \)

[5 marks]

Answer: ___________________________
For sequence A, \( \text{\textit{n}} \text{th term} = \frac{n}{14n + 30} \)

For sequence B, \( \text{\textit{n}} \text{th term} = \frac{2}{n} \)

The \( k \)th term of sequence A equals the \( k \)th term of sequence B.

Work out the value of \( k \).
You must show your working.

[4 marks]

Answer ___________________________
This shape is made from two rectangles. All dimensions are in centimetres.

The perimeter of the shape is 252 cm

Show that \( y = 126 - 45x \) [2 marks]

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Not drawn accurately

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12 (b) The area of the shape is $A$ cm$^2$

Show that $A = 2520x - 450x^2$

[2 marks]

12 (c) Use differentiation to work out the maximum value of $A$ as $x$ varies.

[3 marks]

Answer ________________________________
13  \( f(x) = 3x^2 + 6 \) for all \( x \)
    \( g(x) = \sqrt{x - 5} \quad x \geq 5 \)

13 (a) Work out the value of \( gf(4) \)  [2 marks]

Answer

13 (b) Show that \( fg(x) \) can be written in the form \( a(x - a) \) where \( a \) is an integer.  [2 marks]

Answer
Use the sine rule to work out the size of obtuse angle $x$. 

[3 marks]

Answer: __________ degrees
Here is a sketch of the curve $y = ab^{-x}$ where $a$ and $b$ are positive constants. 

(0, 3) and (2, 0.48) lie on the curve.

Work out the values of $a$ and $b$.  

$[4 \text{ marks}]$

\[
\begin{align*}
  a &= \\
  b &= 
\end{align*}
\]
16. Simplify \( \frac{8x^3 - 50x}{2x(6x^2 - x - 35)} \)

Give your answer in the form \( \frac{ax + b}{cx + d} \) where \( a, b, c \) and \( d \) are integers.

\[ \text{Answer: } \]
By multiplying both sides of the equation by \( x^{\frac{1}{2}} \)

Solve \( 2x^{\frac{3}{2}} - 3x^{\frac{1}{2}} = 7x^{\frac{1}{2}} \) for \( x > 0 \)

Give your answer to 3 significant figures.

You **must** show your working. [4 marks]
How many **odd** numbers greater than 30 000 can be formed from these digits 2 4 6 7 8 with no repetition of any digit? [3 marks]

Answer ____________________________
19 \hspace{1cm} f(x) = 3x^3 - 2x^2 - 7x - 2

19 (a) \hspace{1cm} \text{Use the factor theorem to show that } (3x + 1) \text{ is a factor of } f(x). \hspace{3.5cm} [2 \text{ marks}]

19 (b) \hspace{1cm} \text{Factorise } f(x) \text{ fully.} \hspace{3.5cm} [3 \text{ marks}]

Answer ____________________________________________
20. \( VABCD \) is a pyramid with a horizontal rectangular base \( ABCD \).

\( V \) is directly above the centre of the base.

\[ VA = VB = VC = VD = 10 \text{ cm} \]

\[ AB = 8 \text{ cm} \quad BC = 6 \text{ cm} \]

\( M \) is the midpoint of \( BC \).
Work out the size of angle VMD.

[5 marks]

Answer: __________ degrees
21 Show that \((2n + 3)^3 + n^3\) is divisible by 9 for all integer values of \(n\). [4 marks]