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| **Pearson Edexcel Level 3** | |
| **GCE Mathematics**  **Advanced Subsidiary**  **Paper 1: Pure Mathematics** | |
| **Mock paper Spring 2018**  **Time: 2 hours** | **Paper Reference(s)** |
| **8MA0/01** |
| **You must have:**  **Mathematical Formulae and Statistical Tables, calculator** | |

**Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

**Instructions**

• Use black ink or ball-point pen.

• If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).

• Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.

• Answer the questions in the spaces provided – *there may be more space than you need*.

• You should show sufficient working to make your methods clear. Answers without working may not gain full credit.

• Inexact answers should be given to three significant figures unless otherwise stated.

**Information**

• A booklet ‘Mathematical Formulae and Statistical Tables’ is provided.

• There are 14 questions in this paper. The total mark is 100.

• 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.

• Try to answer every question.

• Check your answers if you have time at the end.

• If you change your mind about an answer, cross it out and put your new answer and any working underneath.

**Answer ALL questions. Write your answers in the spaces provided.**

**1.** A curve has equation

*y* = 2*x*3 – 2*x*2 – 2*x* + 8.

(*a*) Find **.

**(2)**

(*b*) Hence find the range of values of *x* for which *y* is increasing.

Write your answer in set notation.

**(4)**

**(Total for Question 1 is 6 marks)**

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**2.** The quadrilateral *OABC* has ** = 4**i** + 2**j**, ** = 6**i** – 3**j** and ** = 8**i** – 20**j**.

(*a*) Find **.

**(2)**

(*b*) Show that quadrilateral *OABC* is a trapezium.

**(2)**

**(Total for Question 2 is 4 marks)**

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**3.** A tank, which contained water, started to leak from a hole in its base.

The volume of water in the tank 24 minutes after the leak started was 4 m3.

The volume of water in the tank 60 minutes after the leak started was 2.8 m3.

The volume of water, *V* m3, in the tank *t* minutes after the leak started, can be described by a linear model between *V* and *t*.

(*a*) Find an equation linking *V* with *t*.

**(4)**

Use this model to find

(*b*) (i) the initial volume of water in the tank,

(ii) the time taken for the tank to empty.

**(3)**

(*c*) Suggest a reason why this linear model may not be suitable.

**(1)**

**(Total for Question 3 is 8 marks)**

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**4.**

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**Figure 1**

Figure 1 shows a sketch of the curve with equation *y* = g(*x*).

The curve has a single turning point, a minimum, at the point *M*(4, –1.5).

The curve crosses the *x*-axis at two points, *P*(2, 0) and *Q*(7, 0).

The curve crosses the *y*-axis at a single point *R*(0, 5).

(*a*) State the coordinates of the turning point on the curve with equation *y* = 2g(*x*).

**(1)**

(*b*) State the largest root of the equation g(*x* + 1) = 0.

**(1)**

(*c*) State the range of values of *x* for which g′(*x*) ≤ 0.

**(1)**

Given that the equation g(*x*) + *k* = 0, where *k* is a constant, has no real roots,

(*d*) state the range of possible values for *k*.

**(1)**

**(Total for Question 4 is 4 marks)**

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**5.**  f(*x*) = *x*3 + 3*x*2 – 4*x* – 12.

(*a*) Using the factor theorem, explain why f(*x*) is divisible by (*x* + 3).

**(2)**

(*b*) Hence fully factorise f(*x*).

**(3)**

(*c*) Show that ** can be written in the form *A* + **, where *A* and *B* are integers to be found.

**(3)**

**(Total for Question 5 is 8 marks)**

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**6.** (i) Use a counterexample to show that the following statement is false.

“*n*2 – *n* – 1 is a prime number, for 3 ≤ *n* ≤ 10.”

**(2)**

(ii) Prove that the following statement is always true.

“The difference between the cube and the square of an odd number is even.”

For example, 53 – 52 = 100 is even.

**(4)**

**(Total for Question 6 is 6 marks)**

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**7.**  (*a*) Expand **, simplifying each term.

**(2)**

(*b*) Use the binomial expansion to find, in ascending powers of *x*, the first four terms in the expansion of

**,

simplifying each term.

**(4)**

(*c*) Hence find the coefficient of *x* in the expansion of

**.

**(2)**

**(Total for Question 7 is 8 marks)**

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**8.**

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**Figure 2**

Figure 2 shows a sketch of the curve with equation *y* = √*x* , *x* ≥ 0.

The region *R*, shown shaded in Figure 2, is bounded by the curve, the line with equation *x* = 1,

the *x*-axis and the line with equation *x* = *a*, where *a* is a constant.

Given that the area of *R* is 10,

(*a*) find, in simplest form, the value of

(i) **,

(ii) **,

**(4)**

(*b*) show that *a* = 2*k*, where *k* is a rational constant to be found.

**(4)**

**(Total for Question 8 is 8 marks)**

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**9.** Find any real values of *x* such that 2 log4 (2 – *x*) – log4 (*x* + 5) = 1.

**(Total for Question 9 is 6 marks)**

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**10.** A circle *C* has centre (2, 5). Given that the point *P*(–2, 3) lies on *C*.

(*a*) find an equation for *C*.

**(3)**

The line *l* is the tangent to *C* at the point *P*. The point *Q*(2, *k*) lies on *l*.

(*b*) Find the value of *k*.

**(5)**

**(Total for Question 10 is 8 marks)**

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**11.** (i) Solve, for –90° ≤ *θ* < 270°, the equation,

sin (2*θ* + 10°) = –0.6,

giving your answers to one decimal place.

**(5)**

(ii) (*a*) A student’s attempt at the question

“Solve, for –90° < *x* < 90°, the equation 7 tan *x* = 8 sin *x*”

is set out below.

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| --- |
| 7 tan *x* = 8 sin *x*  7 ×  *x* = 8 sin *x*  7 sin *x* = 8 sin *x* cos *x*  7 = 8 cos *x*  cos *x* =  *x* = 29.0° (to 3 sf ) |

Identify two mistakes made by this student, giving a brief explanation of each mistake.

**(2)**

(*b*) Find the smallest positive solution to the equation

7 tan (4*α* + 199°) = 8 sin (4*α* + 199°).

**(2)**

**(Total for Question 11 is 9 marks)**

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**12.**

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**Figure 3**

Figure 3 shows a sketch of the curve *C* with equation *y* = 3*x* – 2√*x* , *x* ≥ 0 and the line *l* with equation *y* = 8*x* – 16.

The line cuts the curve at point *A* as shown in Figure 3.

(*a*) Using algebra, find the *x-*coordinate of point *A*.

**(5)**

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**Figure 4**

The region *R* is shown unshaded in Figure 4.

(*b*) Identify the inequalities that define *R*.

**(3)**

**(Total for Question 12 is 8 marks)**

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**13.**  The growth of pond weed on the surface of a pond is being investigated.

The surface area of the pond covered by the weed, *A* m2, can be modelled by the equation

*A*= 0.2e0.3*t*,

where *t* is the number of days after the start of the investigation.

(*a*) State the surface area of the pond covered by the weed at the start of the investigation.

**(1)**

(*b*) Find the rate of increase of the surface area of the pond covered by the weed, in m2/day, exactly 5 days after the start of the investigation.

**(2)**

Given that the pond has a surface area of 100 m2,

(*c*) find, to the nearest hour, the time taken, according to the model, for the surface of the pond to be fully covered by the weed.

**(4)**

The pond was observed for one month. By the end of the month 90% of the surface area of the pond was covered by the weed.

(*d*) Evaluate the model in light of this information, giving a reason for your answer.

**(1)**

**(Total for Question 13 is 8 marks)**

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**14.**

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**Figure 5**

Figure 5 shows a sketch of the curve *C* with equation *y* = (*x* – 2)2 (*x* + 3).

The region *R*, shown shaded in Figure 5, is bounded by *C*, the vertical line passing through the maximum turning point of *C* and the *x-*axis.

Find the exact area of *R*.

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

**(Total for Question 14 is 9 marks)**

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**TOTAL FOR PAPER IS 100 MARKS**

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