

Paper Reference AAL30/01
Pearson
Edexcel Award

Total Marks

Algebra
Level 3
Calculator NOT allowed

Thursday 9 January 2020 – Morning

Time: 2 hours plus your additional time allowance.

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Ruler, compasses, writing and drawing equipment.

YOU WILL BE GIVEN

Diagram Book

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper or on the separate diagrams – there may be more space than you need.

CALCULATORS ARE NOT ALLOWED.

INFORMATION

The total mark for this paper is 90

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

There may be spare copies of some diagrams.

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.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

You must NOT use a calculator.

1. (a) Expand and simplify
 $(w - y)(w + 2y)$
(2 marks)

(continued on the next page)

1. continued.

(b) Factorise

$$12u^2t^2 + 18ut^3$$

(2 marks)

(Total for Question 1 is 4 marks)

Turn over

2. (a) Look at the diagram for Question 2 in the Diagram Book.

On the grid, shade the region that satisfies all these inequalities.

$$x < 3$$

$$y - x < 5$$

$$7x + 5y > 35$$

Label the region **R**
(5 marks)

(continued on the next page)

2. continued.

(b) Write down the coordinates of each of the points, with integer coordinates, that satisfy

$$x < 3$$

$$y - x < 5$$

$$7x + 5y > 35$$

(1 mark)

(Total for Question 2 is 6 marks)

Turn over

3. Solve

$$3k^2 - 27 \geq 0$$

(Total for Question 3 is 2 marks)

Turn over

4. Look at the diagram for Question 4 in the Diagram Book.

John went for a run.

The diagram shows part of his distance–time graph.

What does this graph show about John's speed for values of t between $t = 20$ and $t = 28$?

(Total for Question 4 is 1 mark)

5. Here is a quadratic equation.

$$3x^2 - 7x + 5 = 0$$

- (a) (i) Calculate the discriminant of this equation.
(2 marks)

- (ii) State what your answer tells you about the roots of the equation $3x^2 - 7x + 5 = 0$
(1 mark)

(continued on the next page)

Turn over

5. continued.

- (b) Find the sum and the product of the roots of the equation $10x^2 = 3 - 5x$
(3 marks)

sum = _____

product = _____

(Total for Question 5 is 6 marks)

Turn over

6. Look at the diagram for Question 6 in the Diagram Book.

On the grid of squares, construct the locus of points that are 3 units from the point $(-1, 1)$
Each square is one unit.

(Total for Question 6 is 2 marks)

7. (a) Simplify
 $(p^{-2})^{-4}$
(1 mark)

(continued on the next page)

7. continued.

(b) Simplify

$$(16t^2)^{\frac{3}{2}}$$

(2 marks)

(continued on the next page)

Turn over

7. continued.

(c) Simplify fully

$$\frac{y^2 - 9}{(y - 3)^2 (y + 3)^2}$$

(2 marks)

(Total for Question 7 is 5 marks)

Turn over

8. The straight line L_1 has equation $y = \frac{1}{2}x - 1$

- (a) Write the equation of L_1 in the form
 $ax + by = c$ where a , b and c are integers.
(1 mark)

(continued on the next page)

Turn over

8. continued.

The straight line L_2 is parallel to L_1 and passes through the point with coordinates $(-2, -6)$

(b) Find an equation for L_2 in the form $y = mx + c$
(3 marks)

Answer space continues on the next page.

8. (b) continued.

(Total for Question 8 is 4 marks)

9. $t = \frac{n}{5 - 2n}$

- (a) Find the value of t when $n = \frac{1}{2}$
(1 mark)

(continued on the next page)

9. continued.

Remember:

$$t = \frac{n}{5 - 2n}$$

(b) Find the value of t when $n = \sqrt{5}$

Give your answer in the form $c + \sqrt{d}$ where c and d are integers.

(4 marks)

(continued on the next page)

Turn over

9. continued.

(c) Make n the subject of the formula $t = \frac{n}{5 - 2n}$
(3 marks)

(Total for Question 9 is 8 marks)

10. (a) (i) Write the equation

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

in the form $ax^2 + bx + c = 0$ where a , b ,
and c are integers.

(1 mark)

(continued on the next page)

Turn over

10. (a) continued.

(ii) Hence use the quadratic formula to solve the equation

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

Give your answer in the form

$\frac{p \pm \sqrt{q}}{6}$ where p and q are integers.

(3 marks)

Answer space continues on the next page.

10. (a) (ii) continued.

(continued on the next page)

10. continued.

(b) Solve the equation

$$(x + 3)^2 = (x + 3)$$

(3 marks)

(continued on the next page)

Turn over

10. continued.

(c) Write the quadratic expression

$x^2 - 8x + 3$ in the form $(x + m)^2 + n$

where m and n are integers.

(2 marks)

(Total for Question 10 is 9 marks)

Turn over

11. Here are the first five terms of an arithmetic series.

25 35 45 55 65

(a) Find the sum of the first 120 terms of this series.

(2 marks)

(continued on the next page)

Turn over

11. continued.

Remember:

Here are the first five terms of an arithmetic series.

25 35 45 55 65

The p th term of this series is the first term to be greater than 1000

**(b) Find the value of p
(3 marks)**

Answer space continues on the next page.

11. (b) continued.

(Total for Question 11 is 5 marks)

12. The equation of the straight line **L** is
 $4x + 3y + 2 = 0$

(a) Find the gradient of **L**
(2 marks)

(continued on the next page)

12. continued.

The straight line **L** is the normal to a curve at the point **A(1, −2)**

(b) Find an equation of the tangent to this curve at A

Give your answer in the form $px + qy + r = 0$ where p , q and r are integers.

(3 marks)

Answer space continues on the next page.

12. (b) continued.

(Total for Question 12 is 5 marks)

13. Look at the diagram for Question 13(a) in the Diagram Book.

It shows a speed–time graph for a particle moving in a straight line.

(a) (i) Use the trapezium rule to find an estimate for the area of the region under the curve between $t = 0$, $t = 16$ and the time axis.

Use 4 strips of equal width.

(3 marks)

Answer space continues on the next page.

13. (a) (i) continued.

(ii) What does this area represent?

(1 mark)

(continued on the next page)

13. continued.

(b) (i) Look at the diagram for Question 13(b) in the Diagram Book.

On the grid in the Diagram Book draw the tangent to the curve at $t = 12$

(1 mark)

(ii) Calculate the gradient of this tangent.

(2 marks)

(continued on the next page)

Turn over

13. continued.

(c) What does the gradient of the curve at the point where $t = 12$ represent?

(1 mark)

(Total for Question 13 is 8 marks)

14. (a) Simplify

$$\frac{1}{\sqrt{2}} + \frac{1}{(\sqrt{2})^3} + \frac{1}{(\sqrt{2})^5}$$

Give your answer in the form

$$\frac{a}{b\sqrt{c}} \text{ where } a, b \text{ and } c \text{ are integers.}$$

(3 marks)

Answer space continues on the next page.

14. (a) continued.

(continued on the next page)

Turn over

14. continued.

(b) Simplify

$$\frac{\sqrt{20} + \sqrt{5}}{\sqrt{20} - \sqrt{5}}$$

(3 marks)

Answer space continues on the next page.

14. (b) continued.

(Total for Question 14 is 6 marks)

15. r is proportional to the cube root of v

$$r = 15 \text{ when } v = 27$$

- (a) Find a formula for r in terms of v
(3 marks)

(continued on the next page)

Turn over

15. continued.

**(b) Look at the diagram for Question 15(b) in the
Diagram Book.**

**Sketch the graph of r against v for $v \geq 0$
(1 mark)**

(Total for Question 15 is 4 marks)

16. Look at the diagram for Question 16 in the Diagram Book.

It shows the graph of $y = \sin x^\circ$ for $-180 \leq x \leq 180$

- (a) Use the graph in the Diagram Book to find an estimate for each of the solutions of the equation

$$4 \sin x^\circ = 2 \text{ for } -180 \leq x \leq 180$$

(2 marks)

(continued on the next page)

16. continued.

- (b) Use the graph in the Diagram Book to find an estimate for each of the solutions of the equation

$$\sin(x + 30)^\circ = 0.5 \text{ for } -180 \leq x \leq 180$$

(2 marks)

(continued on the next page)

Turn over

16. continued.

Look at the diagram for Question 16(c) in the Diagram Book.

It shows the graph of $y = \cos x^\circ$ for $-180 \leq x \leq 180$

- (c) On the grid in the Diagram Book, sketch the graph of $y = \cos \frac{1}{2}x^\circ$ for $-180 \leq x \leq 180$ (2 marks)**

(Total for Question 16 is 6 marks)

17. Solve, algebraically, the simultaneous equations

$$4x^2 + 4y^2 = 125$$

$$2y = 2x - 5$$

(5 marks)

Answer space continues on the next two pages.

17. continued.

17. continued.

(Total for Question 17 is 5 marks)

Turn over

18. Look at the diagram for Question 18 in the Diagram Book.

Sketch the graph of $y = \frac{1}{2-x}$

Show clearly any asymptotes and the coordinates of any points of intersection of the graph with the axes.

(Total for Question 18 is 4 marks)

TOTAL FOR PAPER IS 90 MARKS

END OF PAPER
