

Paper Reference AAL30/01  
Pearson  
Edexcel Award

Total Marks
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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.**

**Turn over**

## **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.**

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**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)

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(continued on the next page)

**1. continued.**

**(b) Factorise**

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

**(2 marks)**

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**(Total for Question 1 is 4 marks)**

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**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)**

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**(Total for Question 2 is 6 marks)**

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**Turn over**

**3. Solve**

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

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**(Total for Question 3 is 2 marks)**

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**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  $t = 28$ ?**

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**(Total for Question 4 is 1 mark)**

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**5. Here is a quadratic equation.**

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

**(a) (i) Calculate the discriminant of this equation.**

**(2 marks)**

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**(continued on the next page)**

**Turn over**

**5. (a) continued.**

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

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**(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)**

**Answer space continues on the next page.**

**5. (b) continued.**

**sum = \_\_\_\_\_**

**product = \_\_\_\_\_**

**(Total for Question 5 is 6 marks)**

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**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)**

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

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**(continued on the next page)**

**Turn over**

**7. continued.**

**(b) Simplify**

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

**(2 marks)**

**Answer space continues on the  
next page.**

**Turn over**

**7. (b) continued.**

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**(continued on the next page)**

**Turn over**

**7. continued.**

**(c) Simplify fully**

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



**(2 marks)**

**Answer space continues on the  
next page.**

**Turn over**

**7. (c) continued.**

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**(Total for Question 7 is 5 marks)**

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**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)

Answer space continues on the next page.

8. (a) continued.

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(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.

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**(Total for Question 8 is 4 marks)**

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**Turn over**

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

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

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(continued on the next page)

**Turn over**

**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)**

**Answer space continues on the  
next page.**

**Turn over**

**9. (b) continued.**

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**(continued on the next page)**

**Turn over**

**9. continued.**

**(c) Make  $n$  the subject of the**

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

**(3 marks)**

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**(Total for Question 9 is 8 marks)**

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**Turn over**

10. (a) (i) Write the equation

$$\frac{x^2}{2} = \frac{x}{3} + \frac{1}{4} \text{ in the form}$$

$$ax^2 + bx + c = 0 \text{ where}$$

**a**, **b**, and **c** are integers.

(1 mark)

Answer space continues on  
the next page.

**10. (a) (i) continued.**

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**(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**

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

**integers.**

**(3 marks)**

**Answer space continues on the next page.**



**10. (a) (ii) continued.**

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**(continued on the next page)**

**Turn over**

**10. continued.**

**(b) Solve the equation**

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

**(3 marks)**

**Answer space continues on the  
next page.**

**10. (b) continued.**

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**(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)**

**Answer space continues on the next page.**

**10. (c) continued.**

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**(Total for Question 10 is 9 marks)**

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**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)**

**Answer space continues on the next page.**

**11. (a) continued.**

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**(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.**

**Turn over**



**11. (b) continued.**

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**(Total for Question 11 is 5 marks)**

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**Turn over**

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

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

**Answer space continues on the  
next page.**

**12. (a) continued.**

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**(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.**

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**(Total for Question 12 is 5 marks)**

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**Turn over**

**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.**

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**(continued on the next page)**

**Turn over**

**13. (a) continued.**

**(ii) What does this area  
represent?**

**(1 mark)**

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**(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)**

**Answer space continues on the next page.**

**Turn over**

**13. (b) (ii) continued.**

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**(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)**

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

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**Turn over**

14. (a) Simplify

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

Give your answer in the form

$\frac{a}{b\sqrt{c}}$  where **a**, **b** and **c** are

integers.

(3 marks)

Answer space continues on the  
next page.

14. (a) continued.

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(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.**

**Turn over**

**14. (b) continued.**

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**(Total for Question 14 is 6 marks)**

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**Turn over**

**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)**

**Answer space continues on the next page.**



**15. (a) continued.**

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**(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)**

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**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**

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

**(2 marks)**

**Answer space is on the next page.**

**Turn over**

**16. (a) continued.**

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**(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)**

**Answer space continues on the next page.**

**Turn over**

**16. (b) continued.**

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**(continued on the next page)**

**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)**

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**17. Solve, algebraically, the simultaneous equations**

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

$$2y = 2x - 5$$

**(5 marks)**

**Answer space continues on the next three pages.**



17. continued.

Turn over

**17. continued.**

**Turn over**

**17. continued.**

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**(Total for Question 17 is 5 marks)**

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**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)**

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**TOTAL FOR PAPER IS 90 MARKS**

**END OF PAPER**

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