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1. 4037/11/M/J/16 Q8

Solutions to this question by accurate drawing will not be accepted.

Three points have coordinates $A(-8, 6)$, $B(4, 2)$ and $C(-1, 7)$. The line through C perpendicular to AB intersects AB at the point P .

(i) Find the equation of the line AB . [2]

(ii) Find the equation of the line CP . [2]

(iii) Show that P is the midpoint of AB . [3]

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(iv) Calculate the length of CP . [1]

(v) Hence find the area of the triangle ABC . [2]

2. 4037/22/M/J/16 Q5

The coordinates of three points are $A(-2, 6)$, $B(6, 10)$ and $C(p, 0)$.

(i) Find the coordinates of M , the mid-point of AB . [2]

(ii) Given that CM is perpendicular to AB , find the value of the constant p . [2]

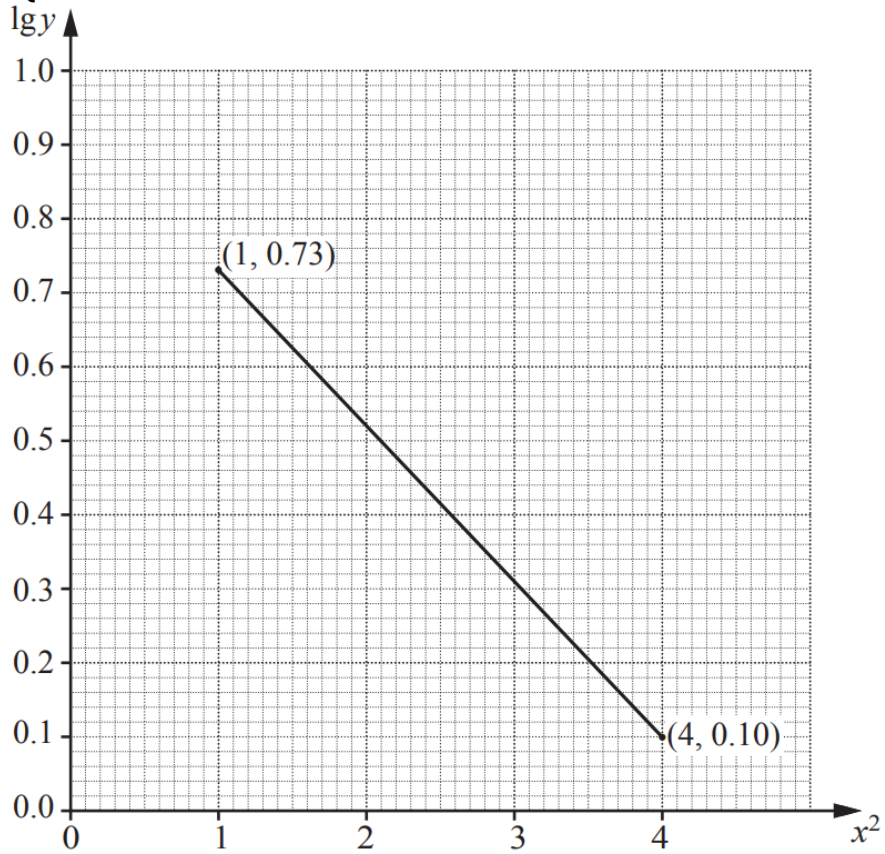
(iii) Find angle MCB . [3]

3. 4037/22/M/J/16 Q8

Find the coordinates of the points of intersection of the curve $4 + \frac{5}{y} + \frac{3}{x} = 0$ and the line $y = 15x + 10$.

[6]

4. 4037/12/M/J/16 Q8



Variables x and y are such that when $\lg y$ is plotted against x^2 , the straight line graph shown above is obtained.

(i) Given that $y = Ab^{x^2}$, find the value of A and of b . [4]

(ii) Find the value of y when $x = 1.5$. [2]

(iii) Find the positive value of x when $y = 2$. [2]

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5. 4037/12/M/J/17 Q7

It is given that $y = A(10^{bx})$, where A and b are constants. The straight line graph obtained when $\lg y$ is plotted against x passes through the points $(0.5, 2.2)$ and $(1.0, 3.7)$.

- (i) Find the value of A and of b . [5]

Using your values of A and b , find

- (ii) the value of y when $x = 0.6$, [2]

- (iii) the value of x when $y = 600$. [2]

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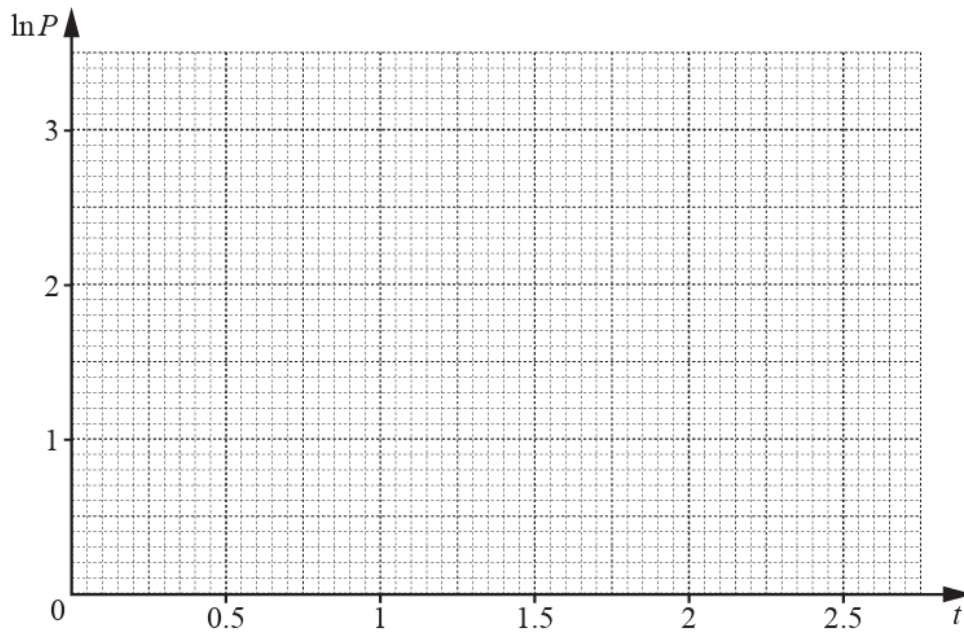
6. 4037/21/M/J/17 Q10

The table shows values of the variables t and P .

| | | | | |
|-----|------|------|------|------|
| t | 1 | 1.5 | 2 | 2.5 |
| P | 4.39 | 8.33 | 15.8 | 30.0 |

(i) Draw the graph of $\ln P$ against t on the grid below.

[2]



(ii) Use the graph to estimate the value of P when $t = 2.2$.

[2]

(iii) Find the gradient of the graph and state the coordinates of the point where the graph meets the vertical axis.

[2]

(iv) Using your answers to part (iii), show that $P = ab^t$, where a and b are constants to be found.

[3]

(v) Given that your equation in part (iv) is valid for values of t up to 10, find the smallest value of t , correct to 1 decimal place, for which P is at least 1000.

[2]

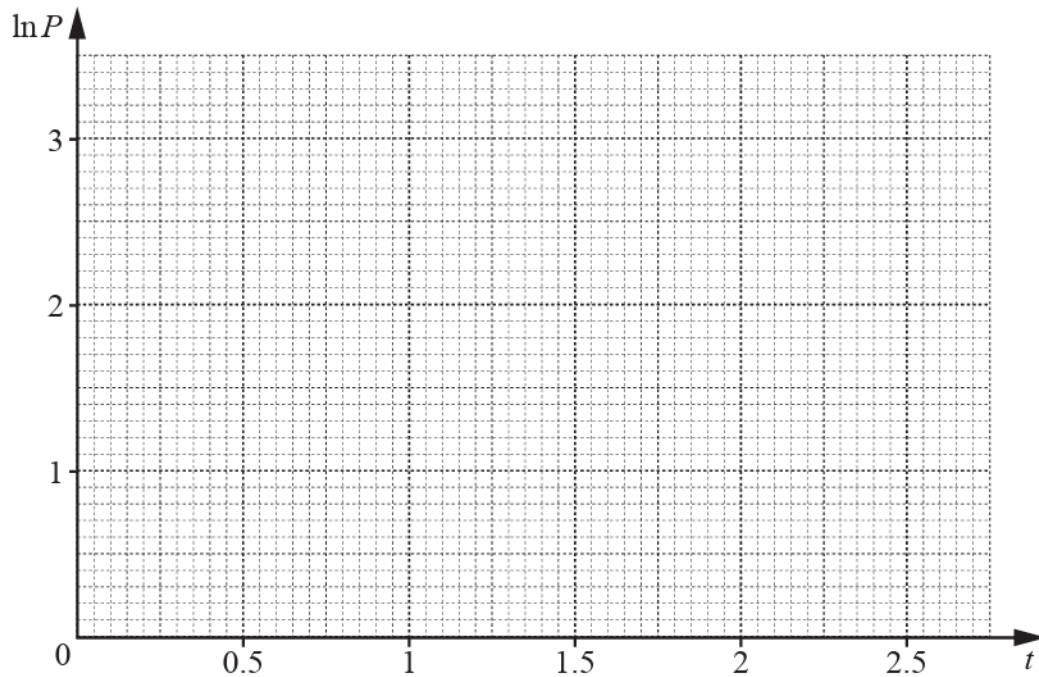
7. 4037/21/M/J/17 Q10

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|-----|------|------|------|------|
| t | 1 | 1.5 | 2 | 2.5 |
| P | 4.39 | 8.33 | 15.8 | 30.0 |

(i) Draw the graph of $\ln P$ against t on the grid below.

[2]



(ii) Use the graph to estimate the value of P when $t = 2.2$.

[2]

(iii) Find the gradient of the graph and state the coordinates of the point where the graph meets the vertical axis.

[2]

(iv) Using your answers to part (iii), show that $P = ab^t$, where a and b are constants to be found.

[3]

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[2]

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8. 4037/22/M/J/17 Q8

Solutions to this question by accurate drawing will not be accepted.

The points A and B are $(-8, 8)$ and $(4, 0)$ respectively.

(i) Find the equation of the line AB . [2]

(ii) Calculate the length of AB . [2]

The point C is $(0, 7)$ and D is the mid-point of AB .

(iii) Show that angle ADC is a right angle. [3]

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9. 4037/12/O/N/17 Q5

When $\lg y$ is plotted against x , a straight line is obtained which passes through the points $(0.6, 0.3)$ and $(1.1, 0.2)$.

(i) Find $\lg y$ in terms of x . [4]

(ii) Find y in terms of x , giving your answer in the form $y = A(10^{bx})$, where A and b are constants. [3]

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10. 4037/13/O/N/17 Q6

When $\ln y$ is plotted against x^2 a straight line is obtained which passes through the points (0.2, 2.4) and (0.8, 0.9).

(i) Express $\ln y$ in the form $px^2 + q$, where p and q are constants. [3]

(ii) Hence express y in terms of z , where $z = e^{x^2}$. [3]

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11. 4037/13/O/N/17 Q12

The line $y = 2x + 1$ intersects the curve $xy = 14 - 2y$ at the points P and Q . The midpoint of the line PQ is the point M .

- (i) Show that the point $\left(-10, \frac{23}{8}\right)$ lies on the perpendicular bisector of PQ . [9]

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The line PQ intersects the y -axis at the point R . The perpendicular bisector of PQ intersects the y -axis at the point S .

(ii) Find the area of the triangle RSM . [3]

12. 4037/11/M/J/18 Q2

Find the equation of the perpendicular bisector of the line joining the points $(1, 3)$ and $(4, -5)$. Give your answer in the form $ax + by + c = 0$, where a , b and c are integers. [5]

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13. 4037/12/M/J/18 Q3

The variables x and y are such that when e^y is plotted against x^2 , a straight line graph passing through the points (5, 3) and (3, 1) is obtained. Find y in terms of x . [5]

14. 4037/21/M/J/18 Q8

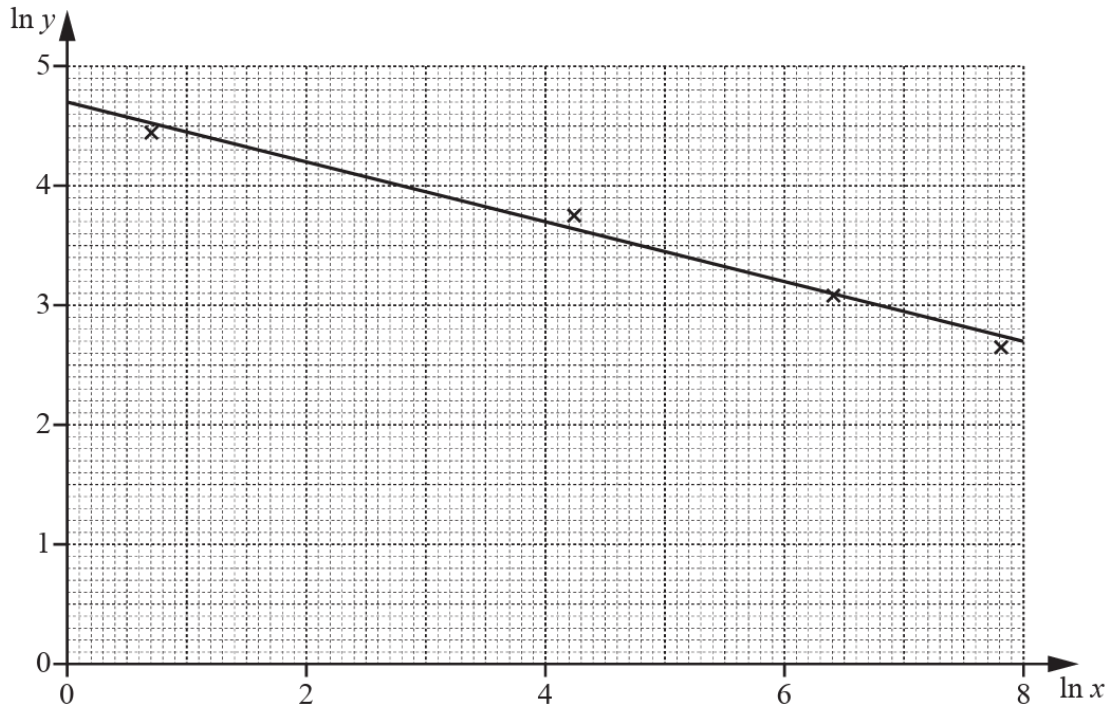
An experiment was carried out recording values of y for certain values of x . The variables x and y are thought to be connected by the relationship $y = ax^n$, where a and n are constants.

(i) Transform the relationship $y = ax^n$ into straight line form. [2]

The values of $\ln y$ and $\ln x$ were plotted and a line of best fit drawn. This is shown in the diagram below.

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(ii) Use the graph to find the value of a and of n , stating the coordinates of the points that you use. [3]

(iii) Find the value of x when $y = 50$.

[2]

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15. 4037/23/O/N/18 Q8

Variables x and y are such that when y^2 is plotted against e^{2x} a straight line is obtained which passes through the points $(1.5, 5.5)$ and $(3.7, 12.1)$. Find

(i) y in terms of e^{2x} , [3]

(ii) the value of y when $x = 3$, [1]

(iii) the value of x when $y = 50$. [3]

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16. 4037/11/M/J/19 Q10

When $\lg y$ is plotted against x^2 a straight line graph is obtained which passes through the points (2, 4) and (6, 16).

(i) Show that $y = 10^{A+Bx^2}$, where A and B are constants. [4]

(ii) Find y when $x = \frac{1}{\sqrt{3}}$. [2]

(iii) Find the positive value of x when $y = 2$. [3]

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17. 4037/12/M/J/19 Q8

When e^y is plotted against $\frac{1}{x}$, a straight line graph passing through the points (2, 20) and (4, 8) is obtained.

(i) Find y in terms of x . [5]

(ii) Hence find the positive values of x for which y is defined. [1]

(iii) Find the exact value of y when $x = 3$. [1]

(iv) Find the exact value of x when $y = 2$. [2]

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18. 4037/21/M/J/19 Q10

Solutions to this question by accurate drawing will not be accepted.

The points A and B have coordinates $(p, 3)$ and $(1, 4)$ respectively and the line L has equation $3x + y = 2$.

(i) Given that the gradient of AB is $\frac{1}{3}$, find the value of p . [2]

(ii) Show that L is the perpendicular bisector of AB . [3]

(iii) Given that $C(q, -10)$ lies on L , find the value of q . [1]

(iv) Find the area of triangle ABC . [2]

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19. 4037/12/O/N/19 Q2

When $\lg y^2$ is plotted against x , a straight line is obtained passing through the points $(5, 12)$ and $(3, 20)$. Find y in terms of x , giving your answer in the form $y = 10^{ax+b}$, where a and b are integers. [5]

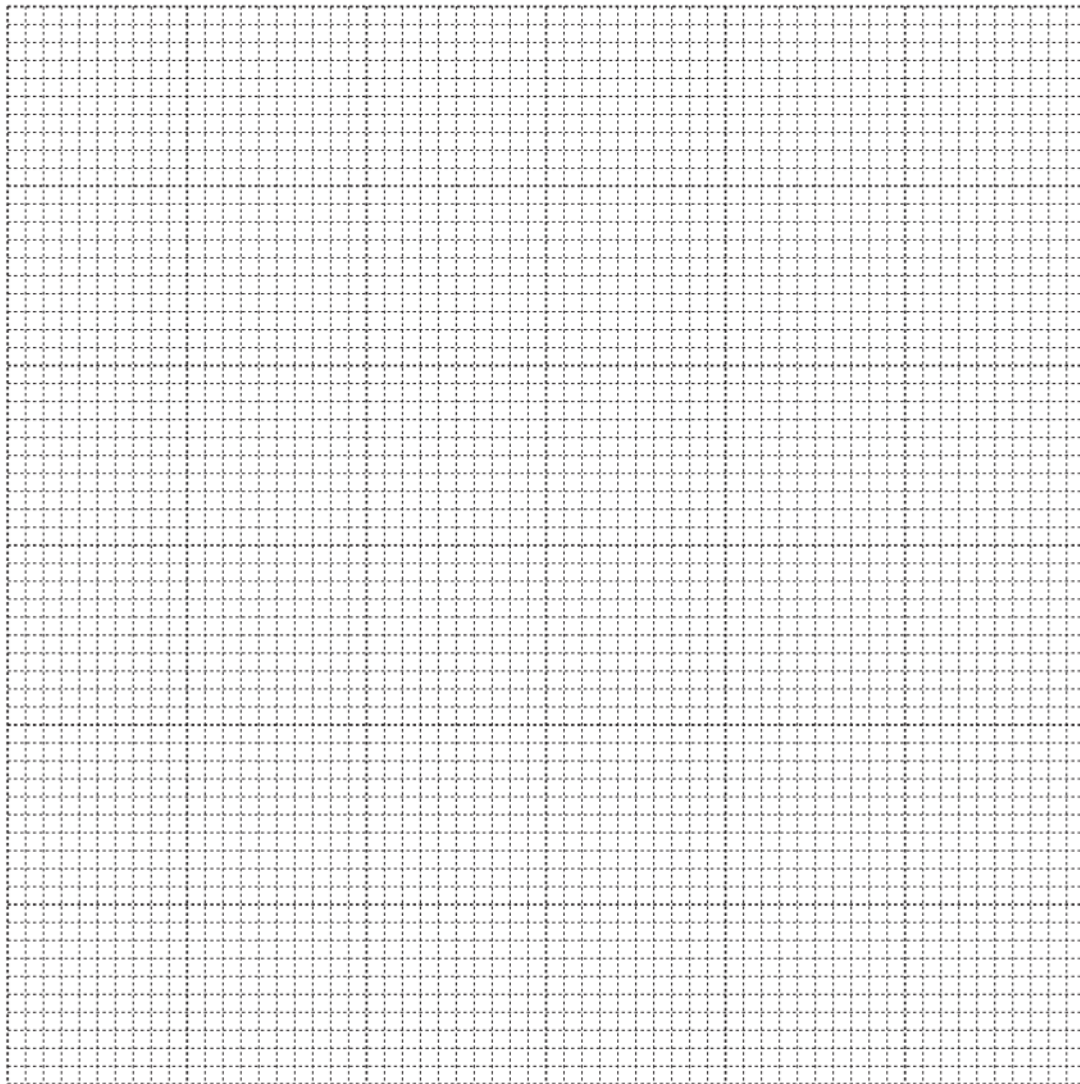
20. 4037/13/O/N/19 Q6

| | | | | | |
|-----|---|------|----|-----|------|
| x | 1 | 1.5 | 2 | 2.5 | 3 |
| y | 6 | 14.3 | 48 | 228 | 1536 |

The table shows values of the variables x and y such that $y = Ab^{x^2}$, where A and b are constants.

- (i) Draw a straight line graph to show that $y = Ab^{x^2}$.

[4]



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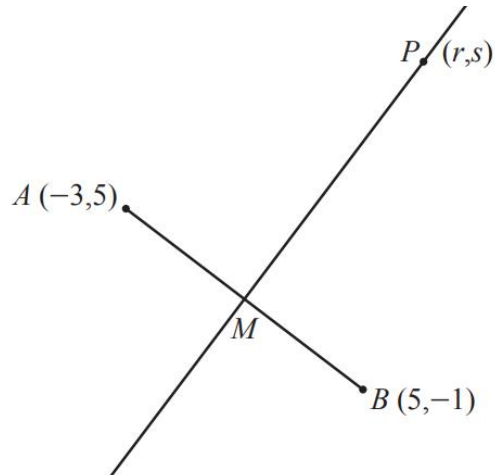
(ii) Use your graph to find the value of A and of b .

[4]

(iii) Estimate the value of x when $y = 100$.

[2]

21. 4037/22/O/N/19 Q9



The diagram shows the points $A(-3, 5)$ and $B(5, -1)$. The mid-point of AB is M and the line PM is perpendicular to AB . The point P has coordinates (r, s) .

(i) Find the equation of the line PM in the form $y = mx + c$, where m and c are exact constants. [5]

(ii) Hence find an expression for s in terms of r . [1]

(iii) Given that the length of PM is 10 units, find the value of r and of s . [5]

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22. 4037/11/M/J/20 Q6

The line $y = 5x + 6$ meets the curve $xy = 8$ at the points A and B .

(a) Find the coordinates of A and of B .

[3]

(b) Find the coordinates of the point where the perpendicular bisector of the line AB meets the line $y = x$.

[5]

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23. 4037/21/M/J/20 Q1

Variables x and y are such that, when $\sqrt[4]{y}$ is plotted against $\frac{1}{x}$, a straight line graph passing through the points $(0.5, 9)$ and $(3, 34)$ is obtained. Find y as a function of x . [4]

24. 4037/22/M/J/20 Q5

Solutions to this question by accurate drawing will not be accepted.

The points A and B are $(4, 3)$ and $(12, -7)$ respectively.

(a) Find the equation of the line L , the perpendicular bisector of the line AB . [4]

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- (b) The line parallel to AB which passes through the point $(5, 12)$ intersects L at the point C . Find the coordinates of C . [4]

25. 4037/13/O/N/20 Q6

It is known that $y = A \times 10^{bx^2}$, where A and b are constants. When $\lg y$ is plotted against x^2 , a straight line passing through the points $(3.63, 5.25)$ and $(4.83, 6.88)$ is obtained.

- (a) Find the value of A and of b . [4]

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Using your values of A and b , find

(b) the value of y when $x = 2$, [2]

(c) the positive value of x when $y = 4$. [2]

26. 4037/22/O/N/20 Q3

(a) Find the equation of the perpendicular bisector of the line joining the points $(12, 1)$ and $(4, 3)$, giving your answer in the form $y = mx + c$. [5]

- (b) The perpendicular bisector cuts the axes at points A and B . Find the length of AB . [3]

27. 4037/12/M/J/21 Q8

Variables x and y are such that $y = Ax^b$, where A and b are constants. When $\lg y$ is plotted against $\lg x$, a straight line graph passing through the points $(0.61, 0.57)$ and $(5.36, 4.37)$ is obtained.

- (a) Find the value of A and of b . [5]

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Using your values of A and b , find

(b) the value of y when $x = 3$, [2]

(c) the value of x when $y = 3$. [2]

28. 4037/21/M/J/21 Q2

Variables x and y are such that, when $\ln y$ is plotted against $\ln x$, a straight line graph passing through the points (6, 5) and (8, 9) is obtained. Show that $y = e^p x^q$ where p and q are integers. [4]

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29. 4037/21/M/J/21 Q5

The curves $y = x^2$ and $y^2 = 27x$ intersect at $O(0, 0)$ and at the point A . Find the equation of the perpendicular bisector of the line OA . [8]

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30. 4037/22/M/J/21 Q6

The points $A(5, -4)$ and $C(11, 6)$ are such that AC is the diagonal of a square, $ABCD$.

(a) Find the length of the line AC . [2]

(b) (i) The coordinates of the centre, E , of the square are $(8, y)$. Find the value of y . [1]

(ii) Find the equation of the diagonal BD . [3]

(iii) Given that the x -coordinate of B is less than the x -coordinate of D , write \vec{EB} and \vec{ED} as column vectors. [2]

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31. 4037/24/M/J/21 Q3

Variables x and y are such that when $\lg y$ is plotted against $\lg x$ a straight line passing through the points $(-1, -4)$ and $(2, 11)$ is obtained. Show that $y = ax^n$, where a and n are integers. [6]

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32. 4037/13/O/N/21 Q8

The curves $y = x^2 + x - 1$ and $2y = x^2 + 6x - 2$ intersect at the points A and B .

(a) Show that the mid-point of the line AB is $(2, 9)$.

[5]

The line l is the perpendicular bisector of AB .

(b) Show that the point $C(12, 7)$ lies on the line l .

[3]

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- (c) The point D also lies on l , such that the distance of D from AB is two times the distance of C from AB . Find the coordinates of the two possible positions of D . [4]

33. 4037/13/O/N/21 Q9

When e^{2y} is plotted against x^2 , a straight line graph passing through the points (4, 7.96) and (2, 3.76) is obtained.

- (a) Find y in terms of x . [5]

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(b) Find y when $x = 1$. [2]

(c) Using your equation from **part (a)**, find the positive values of x for which the straight line exists. [3]

34. 4037/22/O/N/21 Q8

Variables x and y are such that when \sqrt{y} is plotted against $\log_2(x+1)$, where $x > -1$, a straight line is obtained which passes through (2, 10.4) and (4, 15.4).

(a) Find \sqrt{y} in terms of $\log_2(x+1)$. [4]

(b) Find the value of y when $x = 15$. [1]

(c) Find the value of x when $y = 25$.

[3]

35. 4037/12/M/J/22 Q3

Variables x and y are such that, when $\lg(2y + 1)$ is plotted against x^2 , a straight line graph passing through the points (1, 1) and (2, 5) is obtained.

(a) Find y in terms of x .

[4]

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(b) Find the value of y when $x = \frac{\sqrt{3}}{2}$. [1]

(c) Find the value of x when $y = 2$. [2]

36. 4037/21/M/J/22 Q3

Variables x and y are such that when $\sqrt[3]{y}$ is plotted against x^2 , a straight line passing through the points (9, 8) and (16, 1) is obtained. Find y as a function of x . [4]

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37. 4037/13/O/N/22 Q13

The points P and Q have coordinates $(5, -12)$ and $(15, -6)$ respectively. The point R lies on the line l , the perpendicular bisector of the line PQ . The x -coordinate of R is 7.

(a) Find the y -coordinate of R . [4]

(b) The point S lies on l such that its distance from PQ is 3 times the distance of R from PQ . Find the coordinates of the two possible positions of S . [3]

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38. 4037/22/O/N/22 Q11

The coordinates of points A and B are $(-5, 6)$ and $(4, -6)$ respectively. The point C lies on the line AB , between A and B , such that $\frac{AC}{CB} = \frac{1}{2}$.

(a) Find the coordinates of C . [2]

(b) The line CD is perpendicular to AB . Find the equation of CD in the form $y = mx + c$. [4]

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(c) The length of BD is $\sqrt{125}$. Find the coordinates of the two possible positions of point D . [6]

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39. 4037/22/M/J/16 Q10 (a,b)

(a) The graph of the curve $y = p(4^{2x}) - q(4^x)$ passes through the points (0, 2) and (0.5, 14). Find the value of p and of q . [3]

(b) The variables x and y are connected by the equation $y = 10^{2x} - 2(10^x)$. Using the substitution $u = 10^x$, or otherwise, find the exact value of x when $y = 24$. [3]