Year 11 to 12 Maths Transition Material

Most of these questions link to your GCSE work. However, some will require you to complete independent study in order to complete the work. Please reflect in green on the cover of each section after you complete it.
Feel free to email EBU (Emily.butzen@langleyacademy.org) for support materials if needed.

NAME: _____ Date: _____ **HOMEWORK: C1**

After completing this chapter you should be able to

1. simplify expressions and collect like terms
2. apply the rules of indices
3. multiply out brackets
4. factorise expressions including quadratics
5. manipulate surds.

This chapter provides the foundations for many aspects of A level Mathematics. Factorising expressions will enable you to solve equations; it could help sketch the graph of a function. A knowledge of indices is very important when differentiating and integrating. Surds are an important way of giving exact answers to problems and you will meet them again when solving quadratic equations.

Algebra and functions

What grade would you give this piece of work ? **A** **B** **C** **D** **E**

All questions should have been completed, however if there were any you found challeng which of the following did you do?

- discuss it with a colleague? **Yes / no**
- post the question on the discussion board in first class? **Yes / no**
- see a teacher to get extra help with the question? **Yes / no**
-Other;_____ **yes / no**

Were there any questions you still found challenging? **questions_____**

Describe the self study work you did to support/ develop your understanding of the work either in class or at home

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How long did you spend on self study?(in hours) **0-1** **1-2** **2-3** **3+**

What do you feel you have learnt from this work?

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What do you feel you need to practice more in this work?

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TEACHER'S COMMENTS: **MARK/GRADE_____**

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NOW GO BACK AND DO YOUR CORRECTIONS!!

Question	Obtained
1	
2	
3	
4	
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10	
11	
12	
13	
14	
15	
Total/51	

A	41
B	36
C	31
D	26
E	20
U	19

Leave blank

1. Factorise completely

$$x^3 - 4x^2 + 3x.$$

(3)

Q1

(Total 3 marks)

Leave blank

2. Factorise completely

$$x^3 - 9x.$$

(3)

(Total 3 marks)

Q2

Leave blank

3. (a) Write down the value of $16^{\frac{1}{2}}$.

(1)

(b) Find the value of $16^{-\frac{3}{2}}$.

(2)

Q1

(Total 3 marks)

Leave blank

4. (a) Write down the value of $8^{\frac{1}{3}}$.

(1)

(b) Find the value of $8^{-\frac{2}{3}}$.

(2)

Q1

(Total 3 marks)

Leave blank

5. (a) Find the value of $8^{\frac{4}{3}}$.

(2)

(b) Simplify $\dfrac{15x^{\frac{4}{3}}}{3x}$.

(2)

Q2

(Total 4 marks)

Leave blank

6. (a) Write down the value of $16^{\frac{1}{4}}$.

(1)

(b) Simplify $(16x^{12})^{\frac{3}{4}}$.

(2)

(Total 3 marks)

Q2

Leave blank

7. (a) Write down the value of $125^{\frac{1}{3}}$.

(1)

(b) Find the value of $125^{-\frac{2}{3}}$.

(2)

Q1

(Total 3 marks)

Leave blank

8. Given that $32\sqrt{2} = 2^a$, find the value of a.

(3)

Q2

(Total 3 marks)

Leave blank

9. (a) Write $\sqrt{45}$ in the form $a\sqrt{5}$, where a is an integer.

(1)

(b) Express $\dfrac{2(3+\sqrt{5})}{(3-\sqrt{5})}$ in the form $b + c\sqrt{5}$, where b and c are integers.

(5)

Leave blank

Question 9 continued

(Total 6 marks)

Q5

Leave blank

10. (a) Expand and simplify $(4 + \sqrt{3})(4 - \sqrt{3})$.

(2)

(b) Express $\dfrac{26}{4+\sqrt{3}}$ in the form $a + b\sqrt{3}$, where a and b are integers.

(2)

Leave blank

Question 10 continued

(Total 4 marks)

Q6

Leave blank

11. (a) Express $\sqrt{108}$ in the form $a\sqrt{3}$, where a is an integer.

(1)

(b) Express $(2 - \sqrt{3})^2$ in the form $b + c\sqrt{3}$, where b and c are integers to be found.

(3)

(Total 4 marks)

Q2

Leave blank

12. Simplify $(3+\sqrt{5})(3-\sqrt{5})$.

(2)

(Total 2 marks)

Q1

Leave blank

13. Simplify

$$\frac{5-\sqrt{3}}{2+\sqrt{3}},$$

giving your answer in the form $a + b\sqrt{3}$, where a and b are integers.

(4)

Q3

(Total 4 marks)

Leave blank

14. Expand and simplify $(\sqrt{7} + 2)(\sqrt{7} - 2)$.

(2)

(Total 2 marks)

Q3

Leave blank

15. Simplify

(a) $\left(3\sqrt{7}\right)^2$

(1)

(b) $\left(8+\sqrt{5}\right)\left(2-\sqrt{5}\right)$

(3)

Q1

(Total 4 marks)

NAME: _____ Date: _____ **HOMEWORK: C1**

After completing this chapter you should be able to

1. plot the graph of a quadratic function
2. solve a quadratic function using factorisation
3. complete the square of a quadratic function
4. solve a quadratic equation by using the quadratic formula
5. calculate the discriminant of a quadratic expression
6. sketch the graph of a quadratic function.

The above techniques will enable you to solve many types of equation and inequality. The ability to spot and solve a quadratic equation is extremely important in A level Mathematics.

Quadratic functions

Question	Obtained
1	
2	
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8	
9	
Total/49	

What grade would you give this piece of work ? **A B C D E**

All questions should have been completed, however if there were any you found challeng which of the following did you do?

- **discuss it with a colleague?** **Yes / no**
- **post the question on the discussion board in first class?** **Yes / no**
- **see a teacher to get extra help with the question?** **Yes / no**
- **-Other;_____** **yes / no**

Were there any questions you still found challenging? **questions_____**

Describe the self study work you did to support/ develop your understanding of the work either in class or at home

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_____

How long did you spend on self study?(in hours) **0-1 1-2 2-3 3+**

What do you feel you have learnt from this work?

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What do you feel you need to practice more in this work?

_____

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TEACHER'S COMMENTS: **MARK/GRADE_____**

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A	39
B	34
C	29
D	25
E	20
U	19

NOW GO BACK AND DO YOUR CORRECTIONS!!

Leave blank

1. $$x^2 - 8x - 29 \equiv (x + a)^2 + b,$$

where a and b are constants.

(a) Find the value of a and the value of b.

(3)

(b) Hence, or otherwise, show that the roots of

$$x^2 - 8x - 29 = 0$$

are $c \pm d\sqrt{5}$, where c and d are integers to be found.

(3)

Leave blank

Question 1 continued

(Total 6 marks)

Q3

Leave blank

2. Given that the equation $kx^2 + 12x + k = 0$, where k is a positive constant, has equal roots, find the value of k.

(4)

Q3

(Total 4 marks)

Leave blank

3. The equation $x^2 + 2px + (3p + 4) = 0$, where p is a positive constant, has equal roots.

(a) Find the value of p.

(4)

(b) For this value of p, solve the equation $x^2 + 2px + (3p + 4) = 0$.

(2)

Leave blank

Question 3 continued

(Total 6 marks)

Q8

Leave blank

4. The equation $2x^2 - 3x - (k + 1) = 0$, where k is a constant, has no real roots.

Find the set of possible values of k.

(4)

Q5

(Total 4 marks)

Leave blank

5. The equation $x^2 + kx + (k+3) = 0$, where k is a constant, has different real roots.

(a) Show that $k^2 - 4k - 12 > 0$.

(2)

(b) Find the set of possible values of k.

(4)

Leave blank

Question 5 continued

(Total 6 marks)

Q7

Leave blank

6. The equation

$$x^2 + kx + 8 = k$$

has no real solutions for x.

(a) Show that k satisfies $k^2 + 4k - 32 < 0$.

(3)

(b) Hence find the set of possible values of k.

(4)

Leave blank

Question 6 continued

(Total 7 marks)

Q8

Leave blank

7. Given that the equation $2qx^2 + qx - 1 = 0$, where q is a constant, has no real roots,

(a) show that $q^2 + 8q < 0$.

(2)

(b) Hence find the set of possible values of q.

(3)

Leave blank

Question 7 continued

(Total 5 marks)

Q8

Leave blank

8. The equation $kx^2 + 4x + (5 - k) = 0$, where k is a constant, has 2 different real solutions for x.

(a) Show that k satisfies

$$k^2 - 5k + 4 > 0.$$

(3)

(b) Hence find the set of possible values of k.

(4)

Leave blank

Question 8 continued

Q7

(Total 7 marks)

Leave blank

9. The equation $x^2 + 3px + p = 0$, where p is a non-zero constant, has equal roots.

Find the value of p.

(4)

Leave blank

Question 9 continued

(Total 4 marks)

Q6

NAME: _____ Date: _____ **HOMEWORK: C1**

After completing this chapter you should be able to

1 solve simultaneous equations by elimination
2 solve simultaneous equations by substitution
3 solve linear and quadratic inequalities.

You will meet simultaneous equations on many occasions during the A level Mathematics course. In Core 1 you will use them to find where lines intersect. You will also use them to solve problems in sequences and series.

Equations and inequalities

Question	Obtained
1	
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7	
Total/45	

What grade would you give this piece of work ? **A** **B** **C** **D** **E**

All questions should have been completed, however if there were any you found challeng which of the following did you do?

- **discuss it with a colleague?** **Yes / no**
- **post the question on the discussion board in first class?** **Yes / no**
- **see a teacher to get extra help with the question?** **Yes / no**
- **-Other;_____** **yes / no**

Were there any questions you still found challenging? **questions_____**

Describe the self study work you did to support/ develop your understanding of the work either in class or at home

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How long did you spend on self study?(in hours) **0-1** **1-2** **2-3** **3+**

What do you feel you have learnt from this work?

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What do you feel you need to practice more in this work?

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TEACHER'S COMMENTS: **MARK/GRADE_____**

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A	36
B	32
C	27
D	23
E	18
U	17

NOW GO BACK AND DO YOUR CORRECTIONS!!

Leave blank

1. Find the set of values of x for which

(a) $3(2x + 1) > 5 - 2x$,

(2)

(b) $2x^2 - 7x + 3 > 0$,

(4)

(c) **both** $3(2x + 1) > 5 - 2x$ **and** $2x^2 - 7x + 3 > 0$.

(2)

Leave blank

Question 1 continued

(Total 8 marks)

Q6

Leave blank

2. Find the set of values of x for which

$$x^2 - 7x - 18 > 0.$$

(4)

Q2

(Total 4 marks)

Leave blank

3. Find the set of values of x for which

(a) $4x - 3 > 7 - x$

(2)

(b) $2x^2 - 5x - 12 < 0$

(4)

(c) **both** $4x - 3 > 7 - x$ **and** $2x^2 - 5x - 12 < 0$

(1)

Leave blank

Question 3 continued

(Total 7 marks)

Q4

Leave blank

4. Solve the simultaneous equations

$$x - 2y = 1,$$

$$x^2 + y^2 = 29.$$

(6)

Leave blank

Question 4 continued

(Total 6 marks)

Q5

Leave blank

5. Solve the simultaneous equations

$$x + y = 2$$

$$x^2 + 2y = 12.$$

(6)

Q45

(Total 6 marks)

Leave blank

6. Solve the simultaneous equations

$$y = x - 2,$$

$$y^2 + x^2 = 10.$$

(7)

Leave blank

Question 6 continued

Q4

(Total 7 marks)

Leave blank

7. (a) By eliminating y from the equations

$$y = x - 4,$$

$$2x^2 - xy = 8,$$

show that

$$x^2 + 4x - 8 = 0.$$

(2)

(b) Hence, or otherwise, solve the simultaneous equations

$$y = x - 4,$$

$$2x^2 - xy = 8,$$

giving your answers in the form $a \pm b\sqrt{3}$, where a and b are integers.

(5)

Leave blank

Question 7 continued

(Total 7 marks)

Q6

NAME: _____ Date: _____ **HOMEWORK: C1**

After completing this chapter you should be able to

1 sketch cubic graphs
2 sketch the graph of the reciprocal function $y = \frac{k}{x}$
3 find where curves intersect
4 understand how the transformations $f(x + a)$, $f(x) + a$, $f(ax)$ and $af(x)$ affect the graph of the curve $y = f(x)$.

You will analyse graphs in greater detail when you start differentiation. It is worth remembering the techniques in this chapter, because they will provide further information about the shape of the function. Later on in the course you will be asked to sketch complex graphs which are simple transformations of a standard function..

Sketching curves

Question	Obtained
1	
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11	
Total/70	

What grade would you give this piece of work ? **A B C D E**

All questions should have been completed, however if there were any you found challeng which of the following did you do?

- discuss it with a colleague? **Yes / no**
- post the question on the discussion board in first class? **Yes / no**
- see a teacher to get extra help with the question? **Yes / no**
-Other;_____ **yes / no**

Were there any questions you still found challenging? **questions_____**

Describe the self study work you did to support/ develop your understanding of the work either in class or at home

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_____

How long did you spend on self study?(in hours) **0-1 1-2 2-3 3+**

What do you feel you have learnt from this work?

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_____

What do you feel you need to practice more in this work?

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TEACHER'S COMMENTS: **MARK/GRADE_____**

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A	56
B	49
C	42
D	35
E	28
U	27

NOW GO BACK AND DO YOUR CORRECTIONS!!

Leave blank

1. **Figure 1**

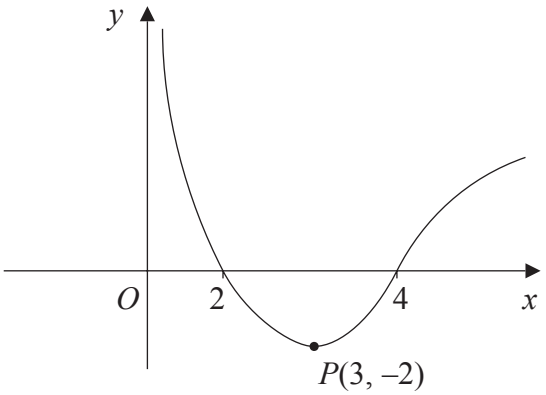

Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve crosses the x-axis at the points (2, 0) and (4, 0). The minimum point on the curve is $P(3, -2)$.

In separate diagrams sketch the curve with equation

(a) $y = -f(x)$,

(3)

(b) $y = f(2x)$.

(3)

On each diagram, give the coordinates of the points at which the curve crosses the x-axis, and the coordinates of the image of P under the given transformation.

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Question 1 continued

Q6

(Total 6 marks)

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2. **Figure 1**

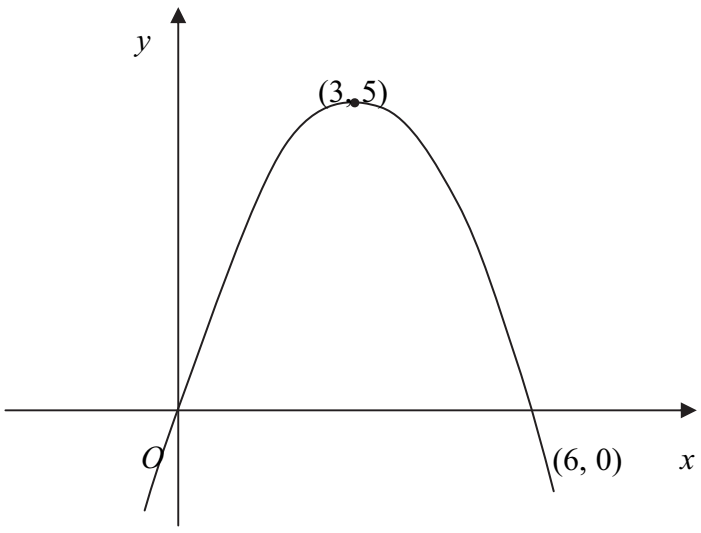


Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve passes through the origin O and through the point (6, 0). The maximum point on the curve is (3, 5).

On separate diagrams, sketch the curve with equation

(a) $y = 3f(x)$,

(2)

(b) $y = f(x + 2)$.

(3)

On each diagram, show clearly the coordinates of the maximum point and of each point at which the curve crosses the x-axis.

Question 2 continued

Leave blank

Q4

(Total 5 marks)

Leave blank

3. **Figure 1**

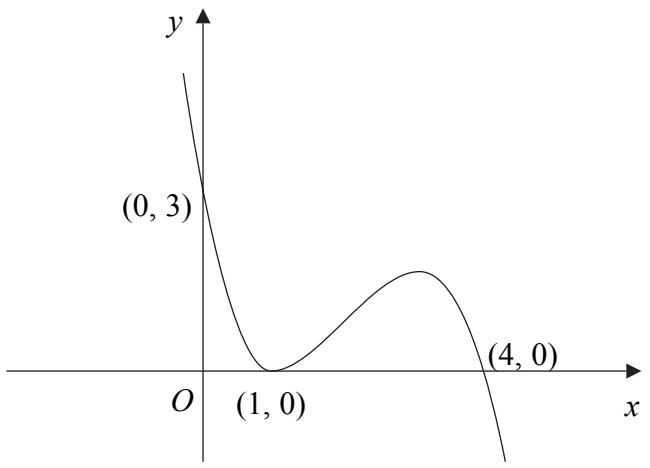


Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve passes through the points (0, 3) and (4, 0) and touches the x-axis at the point (1, 0).

On separate diagrams sketch the curve with equation

(a) $y = f(x + 1)$,

(3)

(b) $y = 2f(x)$,

(3)

(c) $y = f\left(\frac{1}{2}x\right)$.

(3)

On each diagram show clearly the coordinates of all the points where the curve meets the axes.

Question 3 continued

Leave blank

Q6

(Total 9 marks)

Leave blank

4. On separate diagrams, sketch the graphs of

(a) $y = (x + 3)^2$,

(3)

(b) $y = (x + 3)^2 + k$, where k is a positive constant.

(2)

Show on each sketch the coordinates of each point at which the graph meets the axes.

Leave blank

Question 4 continued

Q3

(Total 5 marks)

Leave blank

5. Given that $f(x) = \frac{1}{x}$, $x \neq 0$,

(a) sketch the graph of $y = f(x) + 3$ and state the equations of the asymptotes.

(4)

(b) Find the coordinates of the point where $y = f(x) + 3$ crosses a coordinate axis.

(2)

Leave blank

Question 5 continued

(Total 6 marks)

Q3

Leave blank

6.

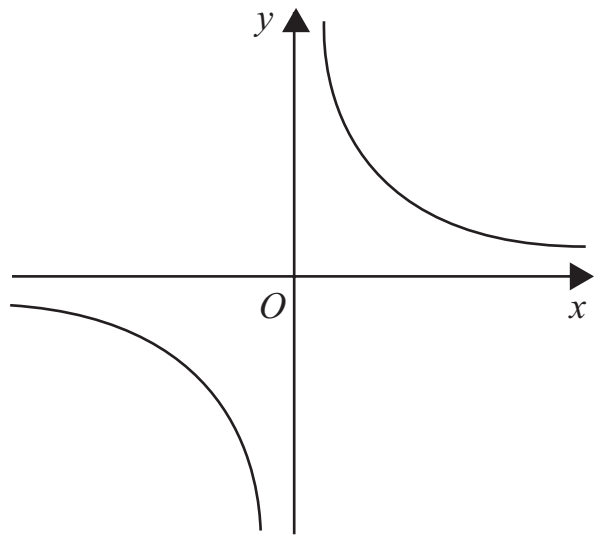


Figure 1

Figure 1 shows a sketch of the curve with equation $y = \frac{3}{x}$, $x \neq 0$.

(a) On a separate diagram, sketch the curve with equation $y = \frac{3}{x+2}$, $x \neq -2$, showing the coordinates of any point at which the curve crosses a coordinate axis.

(3)

(b) Write down the equations of the asymptotes of the curve in part (a).

(2)

Leave blank

Question 6 continued

(Total 5 marks)

Q5

Leave blank

7.

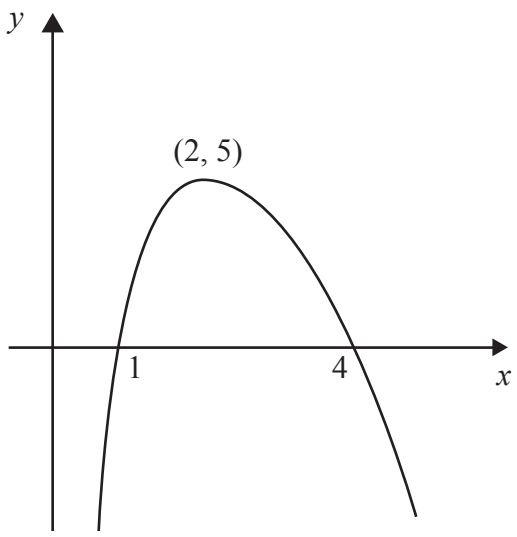


Figure 1

Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve crosses the x-axis at the points (1, 0) and (4, 0). The maximum point on the curve is (2, 5).
In separate diagrams sketch the curves with the following equations.
On each diagram show clearly the coordinates of the maximum point and of each point at which the curve crosses the x-axis.

(a) $y = 2f(x)$,

(3)

(b) $y = f(-x)$.

(3)

The maximum point on the curve with equation $y = f(x + a)$ is on the y-axis.

(c) Write down the value of the constant a.

(1)

Question 7 continued

Leave blank

(Total 7 marks)

Q6

Leave blank

8.

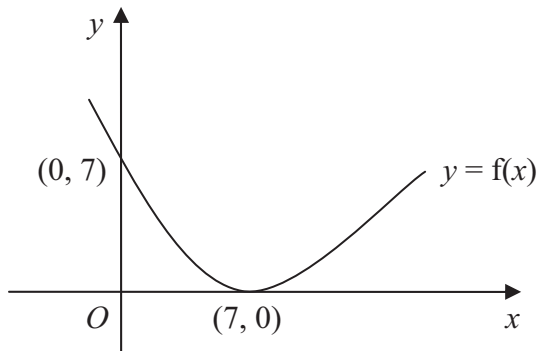


Figure 1

Figure 1 shows a sketch of the curve with equation $y = f(x)$. The curve passes through the point (0, 7) and has a minimum point at (7, 0).

On separate diagrams, sketch the curve with equation

(a) $y = f(x) + 3$,

(3)

(b) $y = f(2x)$.

(2)

On each diagram, show clearly the coordinates of the minimum point and the coordinates of the point at which the curve crosses the y-axis.

Question 8 continued

Leave blank

Q3

(Total 5 marks)

Leave blank

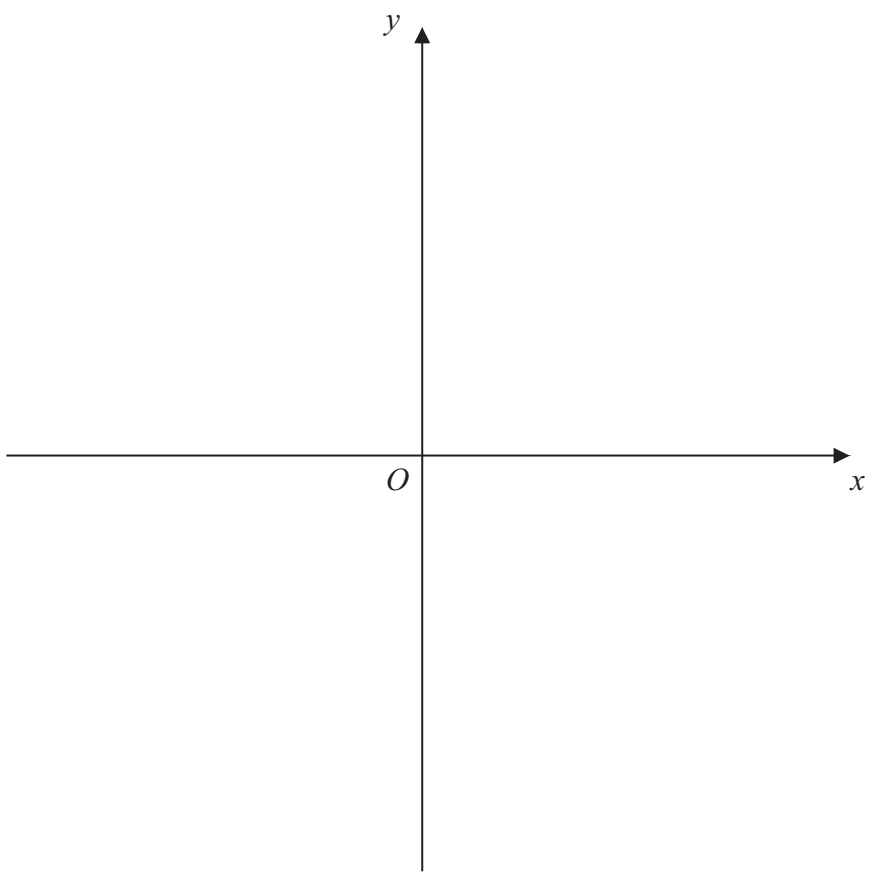
9. The curve C has equation $y = \frac{3}{x}$ and the line l has equation $y = 2x + 5$.

(a) On the axes below, sketch the graphs of C and l, indicating clearly the coordinates of any intersections with the axes.

(3)

(b) Find the coordinates of the points of intersection of C and l.

(6)



Question 9 continued

Leave blank

(Total 9 marks)

Q6

Leave blank

10.

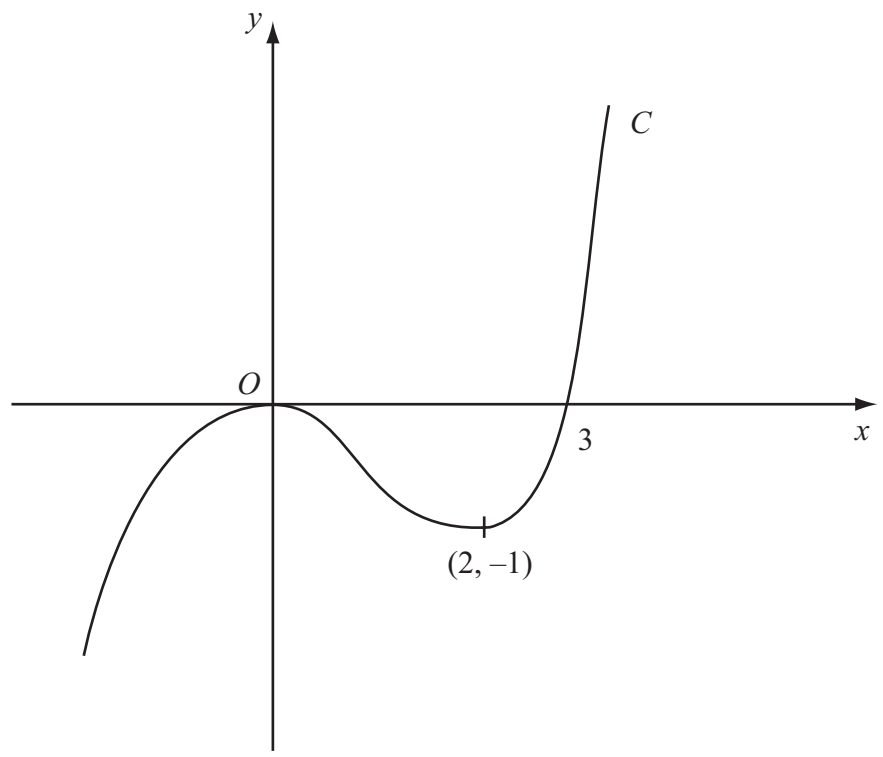


Figure 1

Figure 1 shows a sketch of the curve C with equation $y = f(x)$. There is a maximum at (0, 0), a minimum at (2, –1) and C passes through (3, 0).

On separate diagrams sketch the curve with equation

(a) $y = f(x + 3)$,

(3)

(b) $y = f(-x)$.

(3)

On each diagram show clearly the coordinates of the maximum point, the minimum point and any points of intersection with the x-axis.

Question 10 continued

Leave blank

Q5

(Total 6 marks)

Leave blank

11. The point P $(1, a)$ lies on the curve with equation $y = (x + 1)^2(2 - x)$.

(a) Find the value of a.

(1)

(b) On the axes below sketch the curves with the following equations:

(i) $y = (x + 1)^2(2 - x)$,

(ii) $y = \frac{2}{x}$.

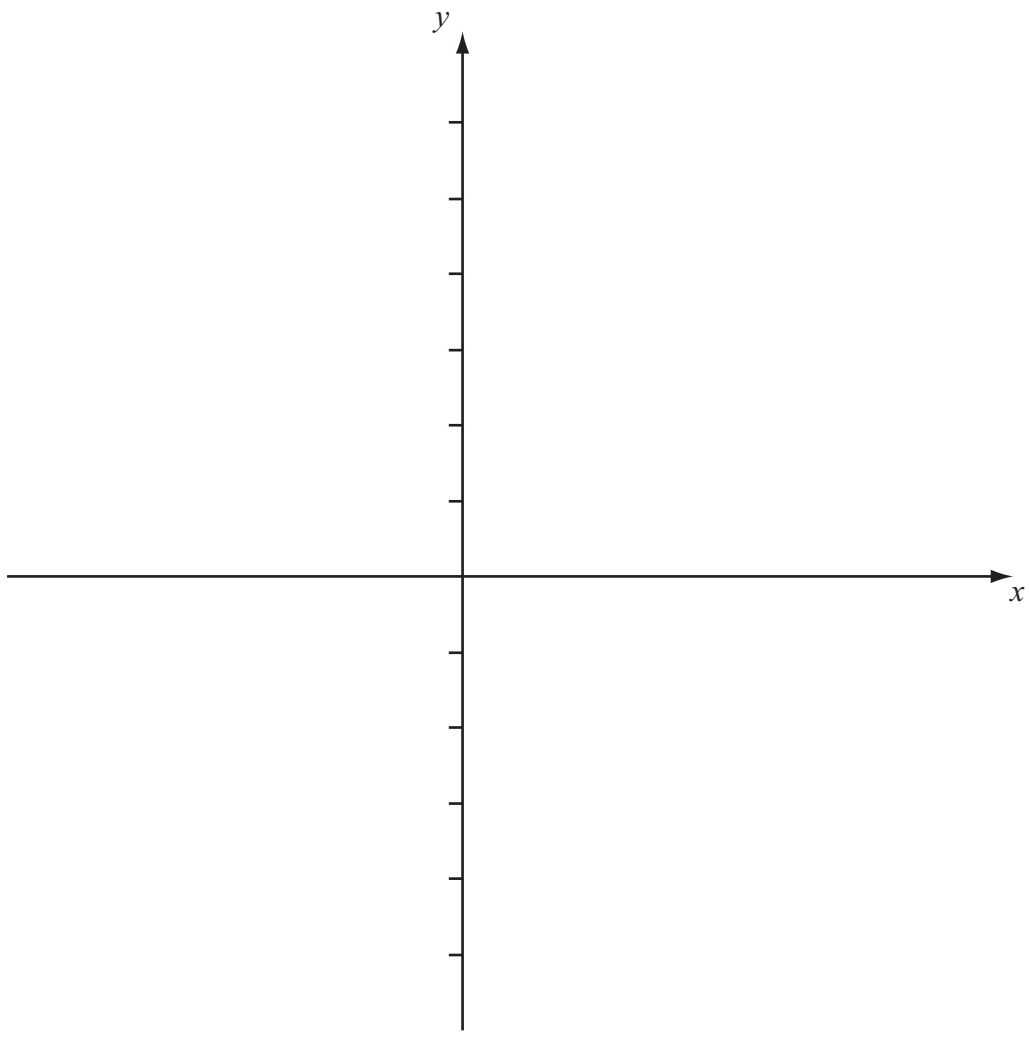
On your diagram show clearly the coordinates of any points at which the curves meet the axes.

(5)

(c) With reference to your diagram in part (b) state the number of real solutions to the equation

$$(x+1)^2(2-x) = \frac{2}{x}.$$

(1)



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Question 11 continued

(Total 7 marks)

Q8

NAME: _____ Date: _____ **HOMEWORK: C1**

After completing this chapter you should be able to

1. understand the link between the equation of a line, and its gradient and intercept
2. calculate the gradient of a line joining a pair of points
3. find the equation of a line in either the form $y = mx + c$ or alternatively $ax + by = c$
4. find the equation of a line passing through a pair of points
5. determine the point where a pair of straight lines intersect
6. know and use the rule concerning perpendicular gradients.

Understanding this chapter will help you find the equation of a tangent and normal to a curve in Chapter 7.

Coordinate geometry in the (x, y) plane

Question	Obtained
1	
2	
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9	
10	
Total/100	

What grade would you give this piece of work ? **A B C D E**

All questions should have been completed, however if there were any you found challeng which of the following did you do?

- **discuss it with a colleague?** **Yes / no**
- **post the question on the discussion board in first class?** **Yes / no**
- **see a teacher to get extra help with the question?** **Yes / no**
- **-Other;_____** **yes / no**

Were there any questions you still found challenging? **questions_____**

Describe the self study work you did to support/ develop your understanding of the work either in class or at home

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How long did you spend on self study?(in hours) **0-1** **1-2** **2-3** **3+**

What do you feel you have learnt from this work?

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What do you feel you need to practice more in this work?

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TEACHER'S COMMENTS: **MARK/GRADE_____**

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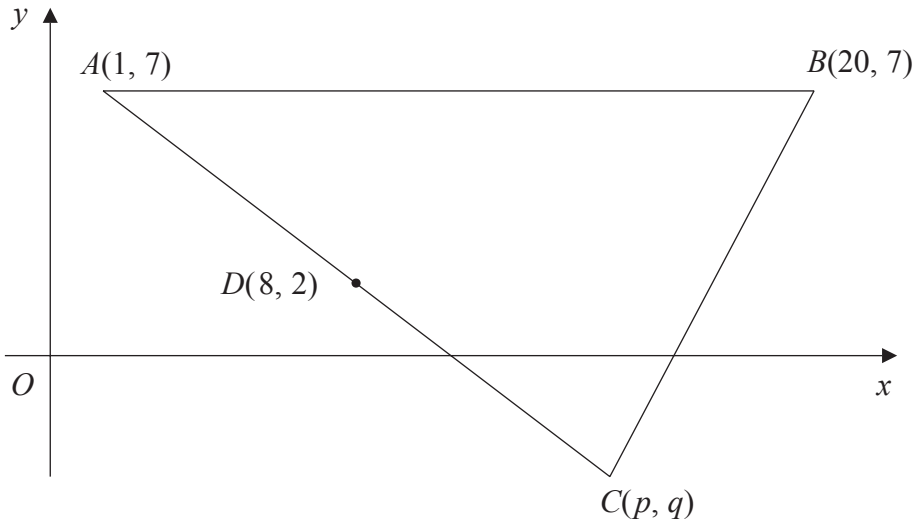
A	80
B	70
C	60
D	50
E	40
U	39

NOW GO BACK AND DO YOUR CORRECTIONS!!

Leave blank

1.

Figure 2



The points $A(1, 7)$, $B(20, 7)$ and $C(p, q)$ form the vertices of a triangle ABC, as shown in Figure 2. The point $D(8, 2)$ is the mid-point of AC.

(a) Find the value of p and the value of q.

(2)

The line l, which passes through D and is perpendicular to AC, intersects AB at E.

(b) Find an equation for l, in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

(c) Find the exact x-coordinate of E.

(2)

Leave blank

Question 1 continued

Q8

(Total 9 marks)

Leave blank

2. The line l_1 passes through the point $(9, -4)$ and has gradient $\frac{1}{3}$.

(a) Find an equation for l_1 in the form $ax + by + c = 0$, where a, b and c are integers.

(3)

The line l_2 passes through the origin O and has gradient -2. The lines l_1 and l_2 intersect at the point P.

(b) Calculate the coordinates of P.

(4)

Given that l_1 crosses the y-axis at the point C,

(c) calculate the exact area of $\triangle OCP$.

(3)

Leave blank

Question 2 continued

(Total 10 marks)

Q8

Leave blank

3. The line L has equation $y = 5 - 2x$.

(a) Show that the point P (3, –1) lies on L.

(1)

(b) Find an equation of the line perpendicular to L, which passes through P. Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

Q3

(Total 5 marks)

Leave blank

4. The line l_1 passes through the points $P(-1, 2)$ and $Q(11, 8)$.

(a) Find an equation for l_1 in the form $y = mx + c$, where m and c are constants.

(4)

The line l_2 passes through the point $R(10, 0)$ and is perpendicular to l_1. The lines l_1 and l_2 intersect at the point S.

(b) Calculate the coordinates of S.

(5)

(c) Show that the length of RS is $3\sqrt{5}$.

(2)

(d) Hence, or otherwise, find the exact area of triangle PQR.

(4)

Leave blank

Question 4 continued

Leave blank

Question 4 continued

Leave blank

Question 4 continued

(Total 15 marks)

Q11

Leave blank

5. The curve C has equation $y = x^2(x-6) + \frac{4}{x}$, $x > 0$

The points P and Q lie on C and have x-coordinates 1 and 2 respectively.

(a) Show that the length of PQ is $\sqrt{170}$.

(4)

(b) Show that the tangents to C at P and Q are parallel.

(5)

(c) Find an equation for the normal to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

Leave blank

Question 5 continued

Leave blank

Question 5 continued

Leave blank

6. The line l_1 has equation $y = 3x + 2$ and the line l_2 has equation $3x + 2y - 8 = 0$.

(a) Find the gradient of the line l_2.

(2)

The point of intersection of l_1 and l_2 is P.

(b) Find the coordinates of P.

(3)

The lines l_1 and l_2 cross the line $y = 1$ at the points A and B respectively.

(c) Find the area of triangle ABP.

(4)

Leave blank

Question 6 continued

Leave blank

Question 6 continued

(Total 9 marks)

Q11

Leave blank

7. The point A (–6, 4) and the point B (8, –3) lie on the line L.

(a) Find an equation for L in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

(b) Find the distance AB, giving your answer in the form $k\sqrt{5}$, where k is an integer.

(3)

(Total 7 marks)

Q4

Turn over

Leave blank

8.

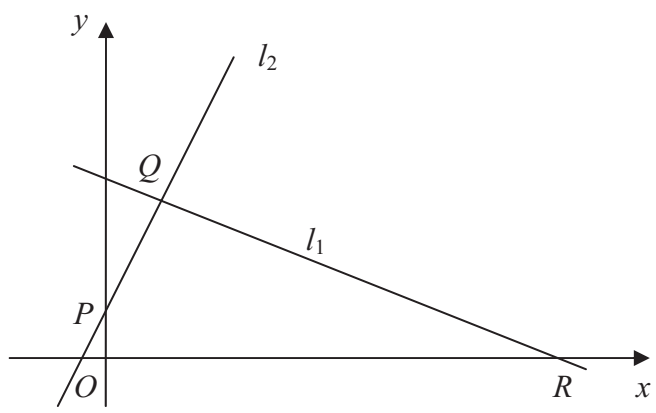


Figure 2

The points Q (1, 3) and R (7, 0) lie on the line l_1, as shown in Figure 2.

The length of QR is $a\sqrt{5}$.

(a) Find the value of a.

(3)

The line l_2 is perpendicular to l_1, passes through Q and crosses the y-axis at the point P, as shown in Figure 2.

Find

(b) an equation for l_2,

(5)

(c) the coordinates of P,

(1)

(d) the area of ΔPQR.

(4)

Question 8 continued

Leave blank

Leave blank

Question 8 continued

Leave blank

Question 8 continued

(Total 13 marks)

Q10

Leave blank

9. The line l_1 passes through the point A (2, 5) and has gradient $-\frac{1}{2}$

(a) Find an equation of l_1, giving your answer in the form $y = mx + c$.

(3)

The point B has coordinates (–2, 7).

(b) Show that B lies on l_1.

(1)

(c) Find the length of AB, giving your answer in the form $k\sqrt{5}$, where k is an integer.

(3)

The point C lies on l_1 and has x-coordinate equal to p.

The length of AC is 5 units.

(d) Show that p satisfies

$$p^2 - 4p - 16 = 0.$$

(4)

Question 9 continued

Leave blank

Leave blank

Question 9 continued

Leave blank

Question 9 continued

(Total 11 marks)

Q10

Leave blank

10.

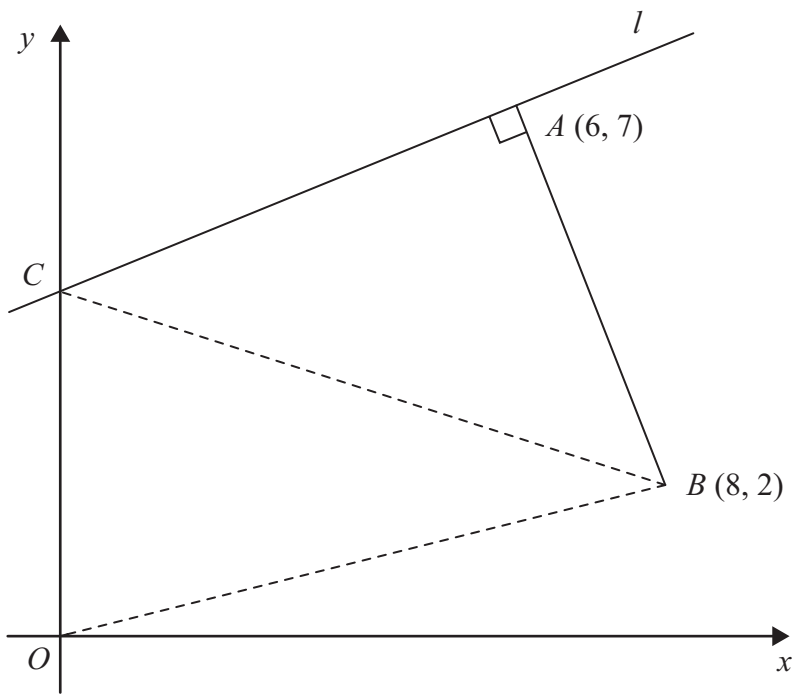


Figure 1

The points A and B have coordinates (6, 7) and (8, 2) respectively.

The line l passes through the point A and is perpendicular to the line AB, as shown in Figure 1.

(a) Find an equation for l in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

Given that l intersects the y-axis at the point C, find

(b) the coordinates of C,

(2)

(c) the area of ΔOCB, where O is the origin.

(2)

Question 10 continued

Leave blank

Leave blank

Question 10 continued

Leave blank

Question 10 continued

(Total 8 marks)

Q8

NAME: _____ Date: _____ **HOMEWORK: C1**

After completing this chapter you should be able to

1. generate a sequence from the *n*th term, or from a recurrence relationship
2. know how to find the *n*th term of an arithmetic sequence, U_n
3. know how to find the sum to *n* terms of an arithmetic series, S_n
4. solve problems on arithmetic series using the formulae for U_n and S_n
5. know the meaning of the symbol Σ.

Sequences and series

What grade would you give this piece of work ? **A B C D E**

All questions should have been completed, however if there were any you found challeng which of the following did you do?

- **discuss it with a colleague?** **Yes / no**
- **post the question on the discussion board in first class?** **Yes / no**
- **see a teacher to get extra help with the question?** **Yes / no**
- **-Other;_____** **yes / no**

Were there any questions you still found challenging? **questions_____**

Describe the self study work you did to support/ develop your understanding of the work either in class or at home

_____

_____

_____

How long did you spend on self study?(in hours) **0-1** **1-2** **2-3** **3+**

What do you feel you have learnt from this work?

_____

_____

_____

_____

What do you feel you need to practice more in this work?

_____

_____

_____

TEACHER'S COMMENTS: **MARK/GRADE_____**

_____

_____

_____

_____

NOW GO BACK AND DO YOUR CORRECTIONS!!

Question	Obtained
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
Total/130	

A	104
B	91
C	78
D	65
E	52
U	51

Leave blank

1. The sequence of positive numbers u_1, u_2, u_3, ... is given by:

$$u_{n+1} = (u_n - 3)^2, \qquad u_1 = 1.$$

(a) Find u_2, u_3 and u_4.

(3)

(b) Write down the value of u_{20}.

(1)

Q2

(Total 4 marks)

Leave blank

2. A sequence $a_1, a_2, a_3, \ldots$ is defined by

$$a_1 = 3,$$
$$a_{n+1} = 3a_n - 5, \quad n \geqslant 1.$$

(a) Find the value of a_2 and the value of a_3.

(2)

(b) Calculate the value of $\sum_{r=1}^{5} a_r$.

(3)

Leave blank

Question 2 continued

Q4

(Total 5 marks)

Leave blank

3. A sequence $a_1, a_2, a_3, \ldots$ is defined by

$$a_1 = k,$$

$$a_{n+1} = 3a_n + 5, \qquad n \geqslant 1,$$

where k is a positive integer.

(a) Write down an expression for a_2 in terms of k.

(1)

(b) Show that $a_3 = 9k + 20$.

(2)

(c) (i) Find $\sum_{r=1}^{4} a_r$ in terms of k.

(ii) Show that $\sum_{r=1}^{4} a_r$ is divisible by 10.

(4)

Leave blank

Question 3 continued

(Total 7 marks)

Q8

Leave blank

4. A sequence is given by:

$$x_1 = 1,$$
$$x_{n+1} = x_n(p + x_n),$$

where p is a constant ($p \neq 0$) .

(a) Find x_2 in terms of p.

(1)

(b) Show that $x_3 = 1 + 3p + 2p^2$.

(2)

Given that $x_3 = 1$,

(c) find the value of p,

(3)

(d) write down the value of x_{2008}.

(2)

Leave blank

Question 4 continued

(Total 8 marks)

Q7

Leave blank

5. A sequence $x_1, x_2, x_3, \ldots$ is defined by

$$x_1 = 1,$$

$$x_{n+1} = ax_n - 3, \quad n \geqslant 1,$$

where a is a constant.

(a) Find an expression for x_2 in terms of a.

(1)

(b) Show that $x_3 = a^2 - 3a - 3$.

(2)

Given that $x_3 = 7$,

(c) find the possible values of a.

(3)

Leave blank

Question 5 continued

(Total 6 marks)

Q5

Leave blank

6. A sequence $a_1, a_2, a_3, \ldots$ is defined by

$$a_1 = k,$$

$$a_{n+1} = 2a_n - 7, \qquad n \geqslant 1,$$

where k is a constant.

(a) Write down an expression for a_2 in terms of k.

(1)

(b) Show that $a_3 = 4k - 21$.

(2)

Given that $\sum_{r=1}^{4} a_r = 43$,

(c) find the value of k.

(4)

Question 6 continued

Leave blank

(Total 7 marks)

Q7

Leave blank

7. The rth term of an arithmetic series is $(2r - 5)$.

(a) Write down the first three terms of this series.

(2)

(b) State the value of the common difference.

(1)

(c) Show that $\sum_{r=1}^{n}(2r-5) = n(n-4)$.

(3)

Leave blank

Question 7 continued

Q5

(Total 6 marks)

Leave blank

8. An arithmetic series has first term a and common difference d.

(a) Prove that the sum of the first n terms of the series is

$$\tfrac{1}{2}n[2a+(n-1)d].$$

(4)

Sean repays a loan over a period of n months. His monthly repayments form an arithmetic sequence.

He repays £149 in the first month, £147 in the second month, £145 in the third month, and so on. He makes his final repayment in the nth month, where $n > 21$.

(b) Find the amount Sean repays in the 21st month.

(2)

Over the n months, he repays a total of £5000.

(c) Form an equation in n, and show that your equation may be written as

$$n^2 - 150n + 5000 = 0.$$

(3)

(d) Solve the equation in part (c).

(3)

(e) State, with a reason, which of the solutions to the equation in part (c) is **not** a sensible solution to the repayment problem.

(1)

Leave blank

Question 8 continued

Leave blank

Question 8 continued

Leave blank

Question 8 continued

(Total 13 marks)

Q9

Leave blank

9. On Alice's 11th birthday she started to receive an annual allowance. The first annual allowance was £500 and on each following birthday the allowance was increased by £200.

(a) Show that, immediately after her 12th birthday, the total of the allowances that Alice had received was £1200.

(1)

(b) Find the amount of Alice's annual allowance on her 18th birthday.

(2)

(c) Find the total of the allowances that Alice had received up to and including her 18th birthday.

(3)

When the total of the allowances that Alice had received reached £32 000 the allowance stopped.

(d) Find how old Alice was when she received her last allowance.

(7)

Leave blank

Question 9 continued

(Total 13 marks)

Q7

Leave blank

10. **A**n athlete prepares for a race by completing a practice run on each of 11 consecutive days. On each day after the first day, he runs further than he ran on the previous day. The lengths of his 11 practice runs form an arithmetic sequence with first term a km and common difference d km.

He runs 9 km on the 11th day, and he runs a total of 77 km over the 11 day period.

Find the value of a and the value of d.

(7)

Leave blank

Question 10 continued

(Total 7 marks)

Q7

Leave blank

11. **A**nn has some sticks that are all of the same length. She arranges them in squares and has made the following 3 rows of patterns:

Row 1 

Row 2 

Row 3 

She notices that 4 sticks are required to make the single square in the first row, 7 sticks to make 2 squares in the second row and in the third row she needs 10 sticks to make 3 squares.

(a) Find an expression, in terms of n, for the number of sticks required to make a similar arrangement of n squares in the nth row.

(3)

Ann continues to make squares following the same pattern. She makes 4 squares in the 4th row and so on until she has completed 10 rows.

(b) Find the total number of sticks Ann uses in making these 10 rows.

(3)

Ann started with 1750 sticks. Given that Ann continues the pattern to complete k rows but does not have sufficient sticks to complete the $(k + 1)$th row,

(c) show that k satisfies $(3k - 100)(k + 35) < 0$.

(4)

(d) Find the value of k.

(2)

Leave blank

Question 11 continued

Leave blank

Question 11 continued

Leave blank

Question 11 continued

(Total 12 marks)

Q9

Leave blank

12. A girl saves money over a period of 200 weeks. She saves 5p in Week 1, 7p in Week 2, 9p in Week 3, and so on until Week 200. Her weekly savings form an arithmetic sequence.

(a) Find the amount she saves in Week 200.

(3)

(b) Calculate her total savings over the complete 200 week period.

(3)

Leave blank

Question 12 continued

(Total 6 marks)

Q4

Leave blank

13. The first term of an arithmetic sequence is 30 and the common difference is –1.5

(a) Find the value of the 25th term.

(2)

The rth term of the sequence is 0.

(b) Find the value of r.

(2)

The sum of the first n terms of the sequence is S_n.

(c) Find the largest positive value of S_n.

(3)

Question 13 continued

Leave blank

Leave blank

Question 13 continued

Leave blank

Question 13 continued

Q11

(Total 7 marks)

Leave blank

14. Sue is training for a marathon. Her training includes a run every Saturday starting with a run of 5 km on the first Saturday. Each Saturday she increases the length of her run from the previous Saturday by 2 km.

(a) Show that on the 4th Saturday of training she runs 11 km.

(1)

(b) Find an expression, in terms of n, for the length of her training run on the nth Saturday.

(2)

(c) Show that the total distance she runs on Saturdays in n weeks of training is $n(n + 4)$ km.

(3)

On the nth Saturday Sue runs 43 km.

(d) Find the value of n.

(2)

(e) Find the total distance, in km, Sue runs on Saturdays in n weeks of training.

(2)

Leave blank

Question 14 continued

Leave blank

Question 14 continued

Leave blank

Question 14 continued

(Total 10 marks)

Q7

Leave blank

15. The first term of an arithmetic series is a and the common difference is d.

The 18th term of the series is 25 and the 21st term of the series is $32\frac{1}{2}$.

(a) Use this information to write down two equations for a and d.

(2)

(b) Show that $a = -17.5$ and find the value of d.

(2)

The sum of the first n terms of the series is 2750.

(c) Show that n is given by

$$n^2 - 15n = 55 \times 40.$$

(4)

(d) Hence find the value of n.

(3)

Question 15 continued

Leave blank

Leave blank

Question 15 continued

Leave blank

Question 15 continued

(Total 11 marks)

Q9

Leave blank

16. A 40-year building programme for new houses began in Oldtown in the year 1951 (Year 1) and finished in 1990 (Year 40).

The numbers of houses built each year form an arithmetic sequence with first term a and common difference d.

Given that 2400 new houses were built in 1960 and 600 new houses were built in 1990, find

(a) the value of d,

(3)

(b) the value of a,

(2)

(c) the total number of houses built in Oldtown over the 40-year period.

(3)

Leave blank

Question 16 continued

(Total 8 marks)

Q5

NAME: _____ Date: _____ **HOMEWORK: C1**

7 Differentiation

After completing this chapter you should be able to

1. estimate the gradient of a curve
2. calculate the gradient function, $\frac{dy}{dx}$ for simple functions
3. calculate the gradient of a curve at any point
4. find the equation of the tangent and normal to a curve at a specified point
5. calculate the second differential $\frac{d^2y}{dx^2}$.

Question	Obtained
1	
2	
3	
4	
5	
6	
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10	
11	
Total/51	

What grade would you give this piece of work ? **A B C D E**

All questions should have been completed, however if there were any you found challeng which of the following did you do?

- **discuss it with a colleague?** **Yes / no**
- **post the question on the discussion board in first class?** **Yes / no**
- **see a teacher to get extra help with the question?** **Yes / no**
- **-Other;_____** **yes / no**

Were there any questions you still found challenging? **questions_____**

Describe the self study work you did to support/ develop your understanding of the work either in class or at home

_____

_____

_____

How long did you spend on self study?(in hours) **0-1 1-2 2-3 3+**

What do you feel you have learnt from this work?

_____

_____

_____

_____

What do you feel you need to practice more in this work?

_____

_____

_____

TEACHER'S COMMENTS: **MARK/GRADE_____**

_____

_____

_____

_____

A	41
B	36
C	31
D	26
E	20
U	19

NOW GO BACK AND DO YOUR CORRECTIONS!!

Leave blank

1. (i) Given that $y = 5x^3 + 7x + 3$, find

(a) $\frac{dy}{dx}$,

(3)

(b) $\frac{d^2y}{dx^2}$.

(1)

Leave blank

2. Given that $y = 6x - \frac{4}{x^2}$, $x \neq 0$,

(a) find $\frac{dy}{dx}$,

(2)

Leave blank

3. Given that $y = 2x^2 - \frac{6}{x^3}, \quad x \neq 0,$

(a) find $\frac{dy}{dx}$,

(2)

(Total 2 marks)

Q4

Leave blank

4. Differentiate with respect to x

(a) $x^4 + 6\sqrt{x}$,

(3)

(b) $\dfrac{(x+4)^2}{x}$.

(4)

Leave blank

Question 4 continued

Q5

(Total 7 marks)

Leave blank

5. Given that

$$y = 4x^3 - 1 + 2x^{\frac{1}{2}}, \quad x > 0,$$

find $\frac{dy}{dx}$.

(4)

Q1

(Total 4 marks)

Leave blank

6. Given that $y = 3x^2 + 4\sqrt{x}, \quad x > 0$, find

(a) $\frac{dy}{dx}$,

(2)

(b) $\frac{d^2y}{dx^2}$,

(2)

Leave blank

7. (a) Write $\frac{2\sqrt{x}+3}{x}$ in the form $2x^p+3x^q$ where p and q are constants.

(2)

Given that $y = 5x - 7 + \frac{2\sqrt{x}+3}{x}$, $\quad x > 0$,

(b) find $\frac{dy}{dx}$, simplifying the coefficient of each term.

(4)

Leave blank

Question 7 continued

(Total 6 marks)

Q5

Leave blank

8. $f(x) = 3x + x^3, \quad x > 0.$

(a) Differentiate to find $f'(x)$.

(2)

Given that $f'(x) = 15$,

(b) find the value of x.

(3)

Leave blank

Question 8 continued

(Total 5 marks)

Q4

Leave blank

9. Given that $\dfrac{2x^2 - x^{\frac{3}{2}}}{\sqrt{x}}$ can be written in the form $2x^p - x^q$,

(a) write down the value of p and the value of q.

(2)

Given that $y = 5x^4 - 3 + \dfrac{2x^2 - x^{\frac{3}{2}}}{\sqrt{x}}$,

(b) find $\dfrac{dy}{dx}$, simplifying the coefficient of each term.

(4)

Leave blank

Question 9 continued

(Total 6 marks)

Q6

Leave blank

10. Given that $y = 2x^3 + \frac{3}{x^2}, \quad x \neq 0,$ find

(a) $\frac{dy}{dx}$

(3)

Leave blank

11.

$$f(x) = \frac{\left(3 - 4\sqrt{x}\right)^2}{\sqrt{x}}, \quad x > 0$$

(a) Show that $f(x) = 9x^{-\frac{1}{2}} + Ax^{\frac{1}{2}} + B$, where A and B are constants to be found.

(3)

(b) Find $f'(x)$.

(3)

(c) Evaluate $f'(9)$.

(2)

Leave blank

Question 11 continued

Leave blank

Question 11 continued

Question 11 continued

Leave blank

Q9

(Total 8 marks)

NAME: _____ Date: _____ **HOMEWORK: C1**

After completing this chapter you should be able to

1. integrate simple functions
2. understand the symbol $\int dx$
3. find the constant of integration by substituting in a given point (x, y).

Integration

Question	Obtained
1	
2	
3	
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10	
11	
12	
13	
14	
Total/64	

What grade would you give this piece of work ? **A** **B** **C** **D** **E**

All questions should have been completed, however if there were any you found challeng which of the following did you do?

- **discuss it with a colleague?** **Yes / no**
- **post the question on the discussion board in first class?** **Yes / no**
- **see a teacher to get extra help with the question?** **Yes / no**
- **-Other;_____** **yes / no**

Were there any questions you still found challenging? **questions_____**

Describe the self study work you did to support/ develop your understanding of the work either in class or at home

_____

_____

_____

How long did you spend on self study?(in hours) **0-1** **1-2** **2-3** **3+**

What do you feel you have learnt from this work?

_____

_____

_____

_____

What do you feel you need to practice more in this work?

_____

_____

_____

TEACHER'S COMMENTS: **MARK/GRADE_____**

_____

_____

_____

_____

A	51
B	45
C	38
D	32
E	26
U	25

NOW GO BACK AND DO YOUR CORRECTIONS!!

Leave blank

1.

(i) Find $\int\left(1+3\sqrt{x}-\frac{1}{x^2}\right)\mathrm{d}x.$

(4)

Leave blank

2. Given that $y = 6x - \frac{4}{x^2}$, $x \neq 0$,

(a) find $\int y \, dx$.

(3)

Leave blank

3. (a) Show that $\frac{(3-\sqrt{x})^2}{\sqrt{x}}$ can be written as $9x^{-\frac{1}{2}} - 6 + x^{\frac{1}{2}}$.

(2)

Given that $\frac{dy}{dx} = \frac{(3-\sqrt{x})^2}{\sqrt{x}}$, $x > 0$, and that $y = \frac{7}{3}$ at $x = 1$,

(b) find y in terms of x.

(6)

Leave blank

Question 3 continued

(Total 8 marks)

Q7

Leave blank

4. Given that $y = 2x^2 - \frac{6}{x^3}, \quad x \neq 0,$

(a) find $\int y \, dx$.

(3)

(Total 3 marks)

Q4

Leave blank

5. The curve with equation $y = f(x)$ passes through the point (1, 6). Given that

$$f'(x) = 3 + \frac{5x^2 + 2}{x^{\frac{1}{2}}}, \quad x > 0,$$

find $f(x)$ and simplify your answer.

(7)

Leave blank

Question 5 continued

(Total 7 marks)

Q8

Leave blank

6. **F**ind $\int \left(6x^2 + 2 + x^{-\frac{1}{2}}\right) \mathrm{d}x$, giving each term in its simplest form.

(4)

Q1

(Total 4 marks)

Leave blank

7. (a) Show that $(4+3\sqrt{x})^2$ can be written as $16+k\sqrt{x}+9x$, where k is a constant to be found.

(2)

(b) Find $\int (4+3\sqrt{x})^2 \mathrm{d}x$.

(3)

(Total 5 marks)

Q6

Leave blank

8. Given that $y = 3x^2 + 4\sqrt{x}, \quad x > 0$, find

(a) $\int y \, dx$.

(3)

Leave blank

9. Find $\int (3x^2 + 4x^5 - 7)\,\mathrm{d}x$.

(4)

Q1

(Total 4 marks)

Leave blank

10. Find $\int (2 + 5x^2)\, dx$.

(3)

Q1

(Total 3 marks)

Leave blank

11. The gradient of a curve C is given by $\frac{dy}{dx} = \frac{(x^2+3)^2}{x^2}$, $x \neq 0$.

(a) Show that $\frac{dy}{dx} = x^2 + 6 + 9x^{-2}$.

(2)

The point (3, 20) lies on C.

(b) Find an equation for the curve C in the form $y = f(x)$.

(6)

Question 11 continued

Leave blank

Question 11 continued

Leave blank

Q11

(Total 8 marks)

Leave blank

12. Find $\int \left(12x^5 - 8x^3 + 3\right) \mathrm{d}x$, giving each term in its simplest form.

(4)

Q2

(Total 4 marks)

Leave blank

13. A curve has equation $y = f(x)$ and passes through the point (4, 22).

Given that

$$f'(x) = 3x^2 - 3x^{\frac{1}{2}} - 7,$$

use integration to find $f(x)$, giving each term in its simplest form.

(5)

Leave blank

Question 13 continued

(Total 5 marks)

Q4

Leave blank

14. Given that $y = 2x^3 + \frac{3}{x^2}, \quad x \neq 0,$ find

(a) $\int y \, \mathrm{d}x$, simplifying each term.

(3)