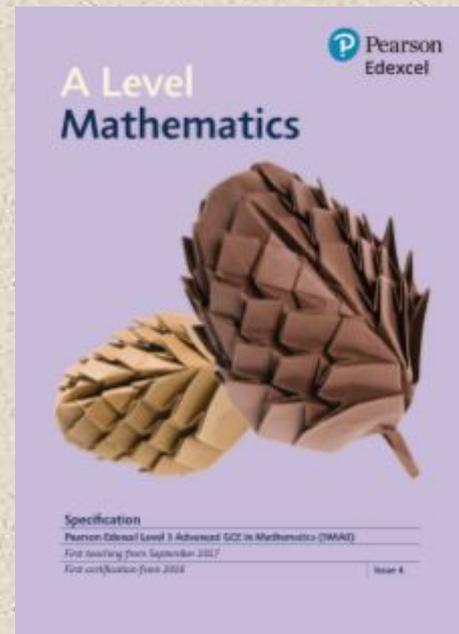


A level Mathematics

3 exams in May/June of year 13
each lasting 2 hours

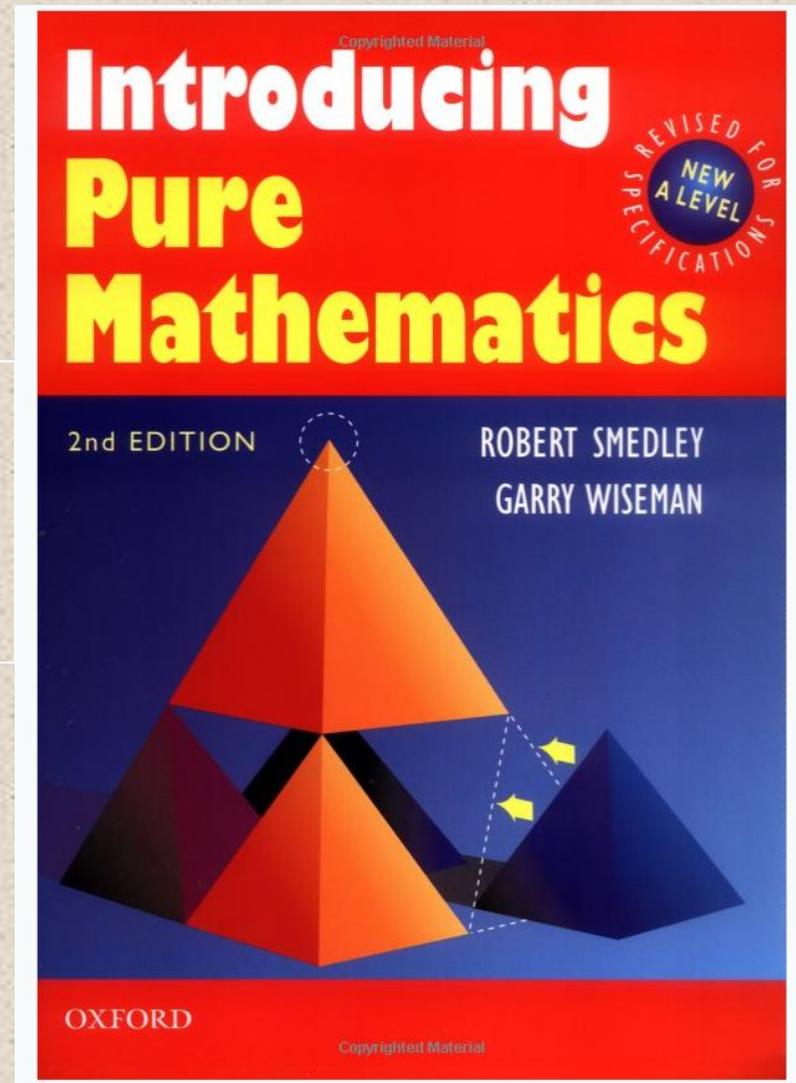
- Pure Mathematics 1
- Pure Mathematics 2
- Statistics and Mechanics



Pure Mathematics

Text Book

Borrow from school
£10 deposit

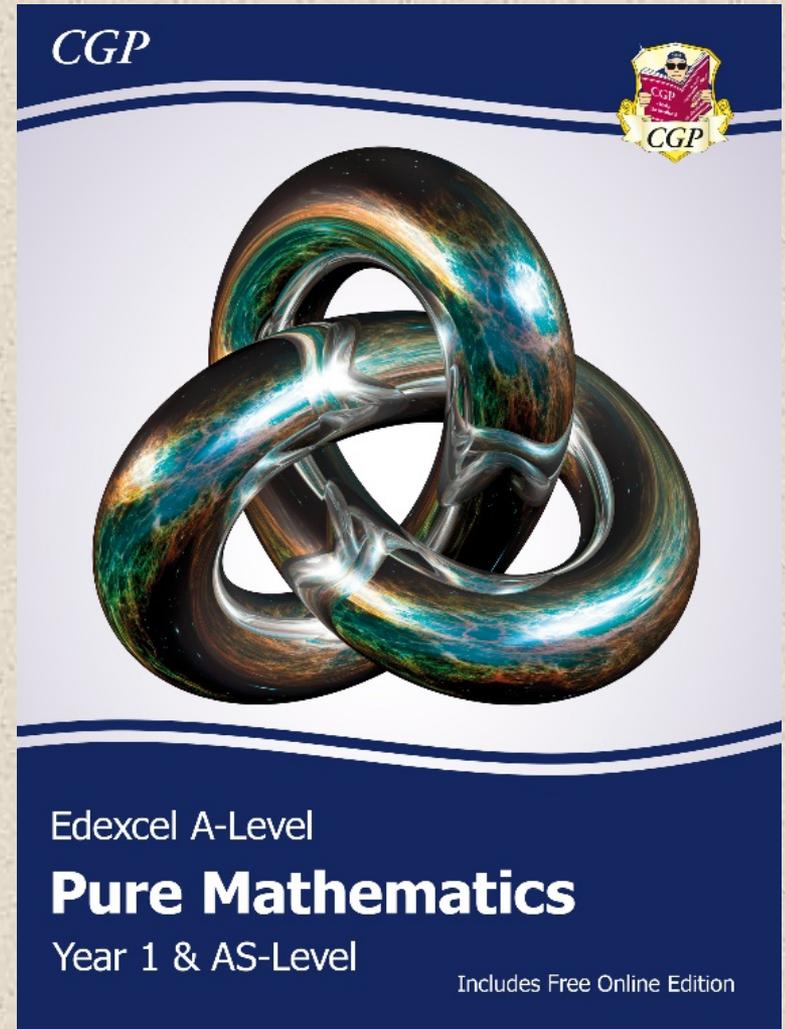


Pure Mathematics

Text Book

Buy through school
in September

Cost: about £11

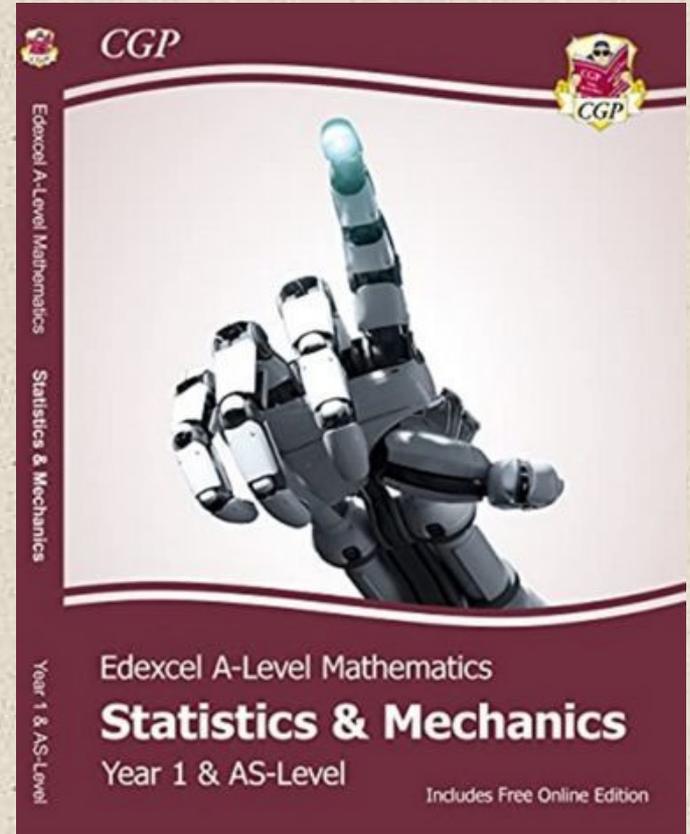


Statistics and Mechanics

Text Books

Buy through school
in September

Cost: about £6 each



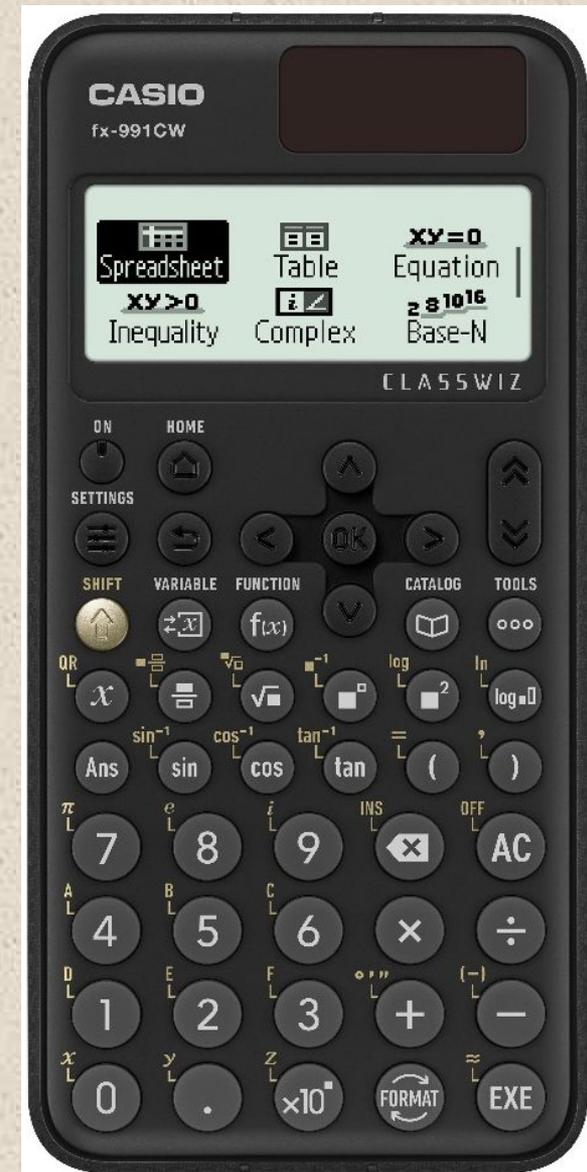
Calculator *fx-991CW*

Buy yourself, or buy
through school in
September

Cost: about £25



The *fx-991EX* is an older model. It has all the same functions and you might be able to find one at a reduced price.



Advanced Maths Support Programme



Transition to A Level Mathematics

We have arranged access to this course to help prepare and support you as you start your A level journey. The modules give you an insight into the level of thinking required at A Level and an opportunity to develop your mathematical knowledge in preparation for the course ahead.

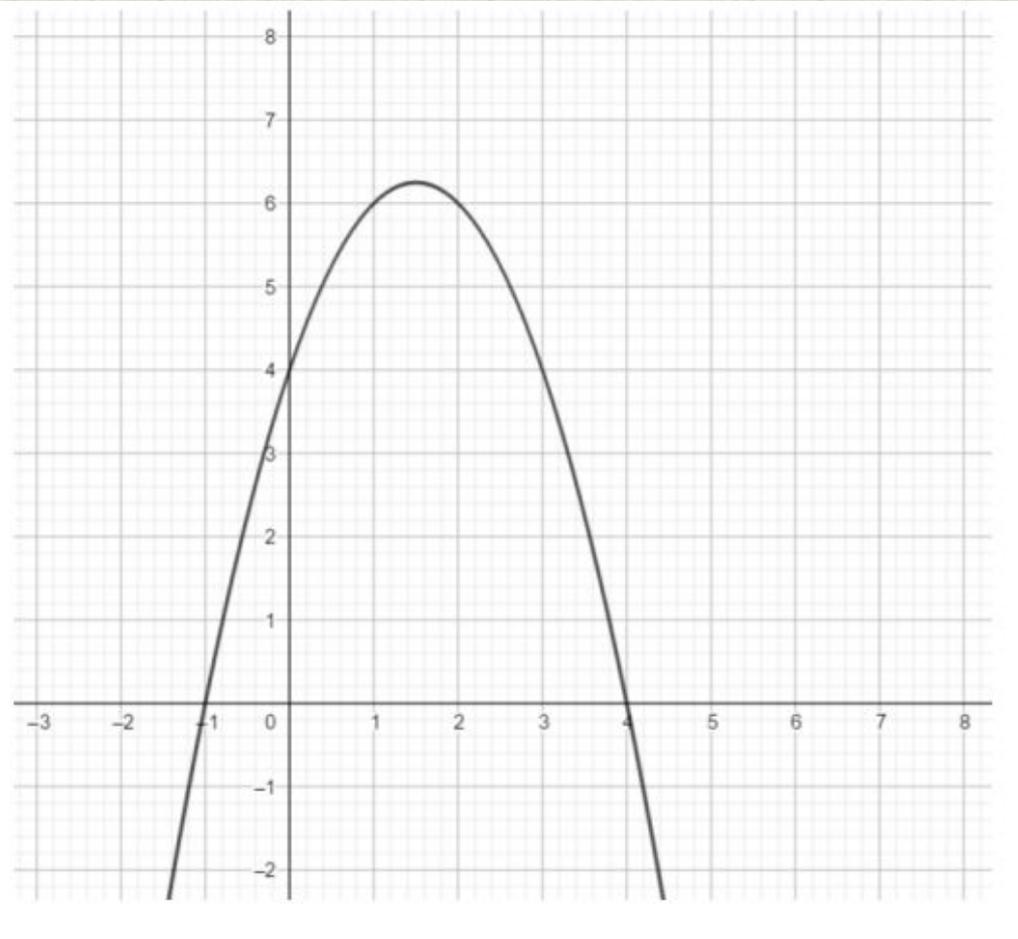
<https://my.integralmaths.org/login/index.php>

Your username and password will be given to you through Google Classroom, or emailed for external candidates

You will be asked to complete at least the Algebraic Manipulation section and print the certificate to show us in September.

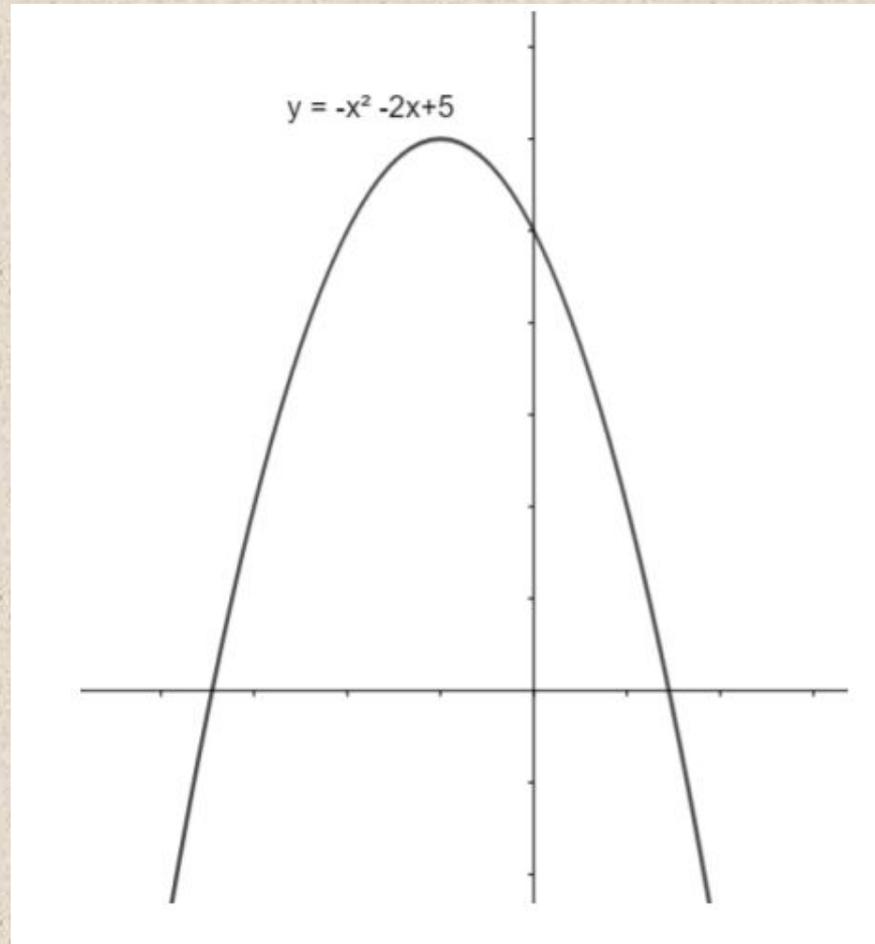
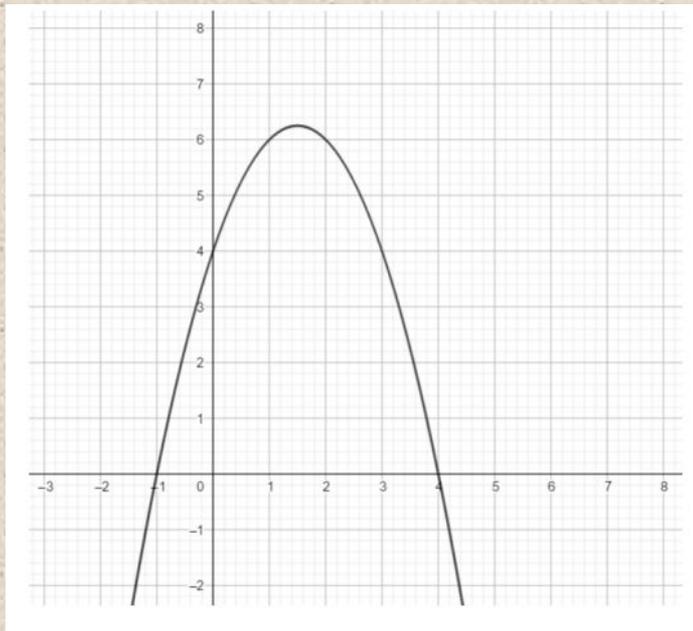
Graphs

What might you be asked about this diagram?



Graphs

What might you be asked about this diagram?
How is it different to the diagram before?



Graphs & Areas

This is an actual exam question.

What is different to GCSE?

7.

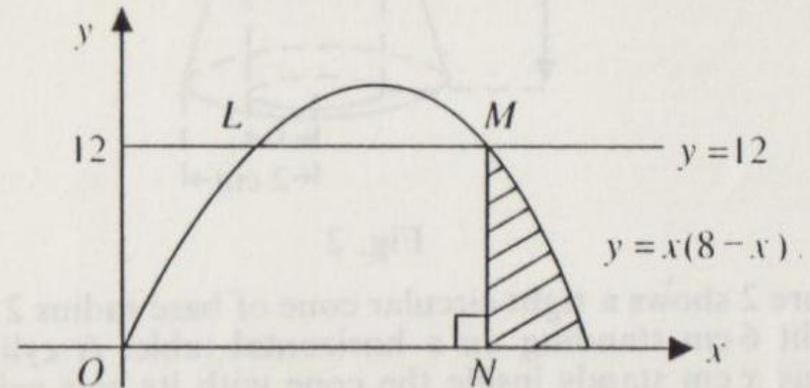


Fig. 1

Figure 1 shows the curve C with equation $y = x(8 - x)$ and the line with equation $y = 12$ which meet at the points L and M .

(a) Determine the coordinates of the point M .

Given that N is the foot of the perpendicular from M onto the x -axis,

(b) calculate the area of the shaded region which is bounded by NM , the curve C and the x -axis.

(10 marks)

Graphs & Gradients

10.

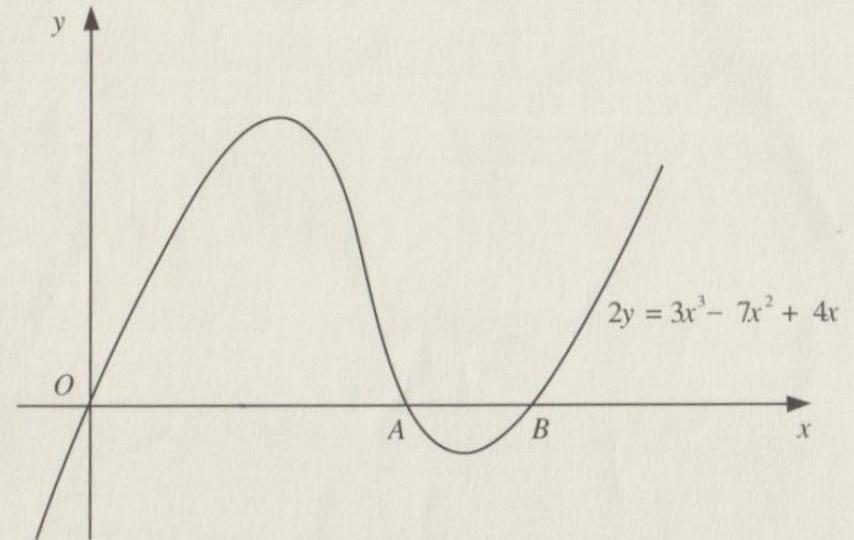


Fig. 2

Figure 2 shows a sketch of part of the curve C with equation

$$2y = 3x^3 - 7x^2 + 4x$$

which meets the x -axis at the origin O , the point $A(1,0)$ and the point B .

(a) Find the coordinates of B .

The normals to the curve C at the points O and A meet at the point N .

(b) Find the coordinates of N .

(c) Calculate the area of $\triangle OAN$.

Graphs

Figure 1 shows the curve with equation $y = f(x)$.

Sketch the curves with equation

- a) $y = f(-x)$,
- b) $y = -f(x)$
- c) $y = f(|x|)$.

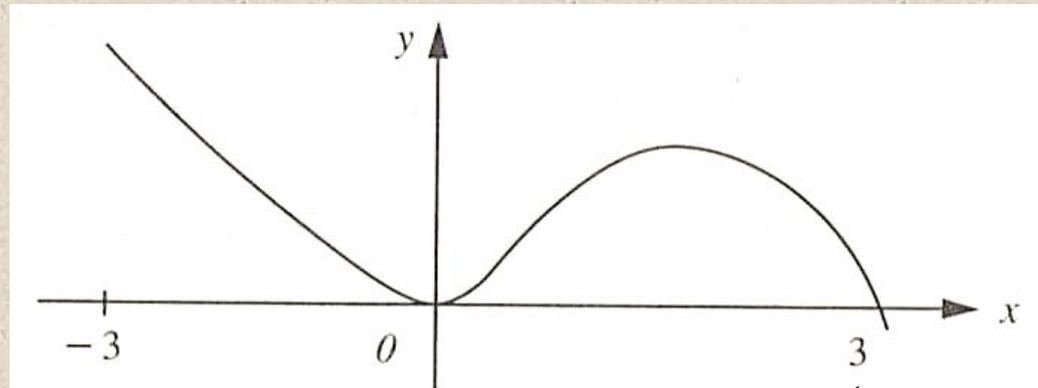


Fig. 1

(9 marks)

Indices

Given that $27^x = 9^{x-1}$, find the value of x .

(5 marks)

Proof

Prove that if x and y are odd integers, their sum is divisible by 2

Factorising

$$f(x) \equiv x^3 + 2x^2 - 11x - 12.$$

- a) show that $(x + 1)$ is a factor of $f(x)$.
- b) solve the equation $f(x)=0$.

(6 marks)

Quadratics & Inequalities

8. $f(x) \equiv 4x^2 + 6x + 7, \quad x \in \mathbb{R}.$

(a) Express $f(x)$ in the form $(ax + b)^2 + c$, stating the values of the constants a , b and c .

Hence, or otherwise,

(b) determine the value of x for which $f(x)$ is a minimum,

(c) find the set of values of x for which $f(x) < 17$.

(11 marks)

Straight Lines

2. The line L_1 has gradient $\frac{1}{7}$ and passes through the point $A(2, 2)$. The line L_2 has gradient -1 and passes through the point $B(4, 8)$. The lines L_1 and L_2 intersect at the point C .
- (a) Find an equation for L_1 and an equation for L_2 .
- (b) Determine the coordinates of C .
- (c) Verify, by calculation, that AC and BC are equal in length.
(9 marks)

Expansions

5. Given that

$$(1 + kx)^8 = 1 + 12x + px^2 + qx^3 + \dots, \text{ for all } x \in \mathbb{R},$$

(a) find the value of k , the value of p and the value of q .

(b) Using your values of k , p and q find the numerical coefficient of the x^3 term in the expansion of $(1 - x)(1 + kx)^8$.

(11 marks)

Trigonometry

5. Find to the nearest 0.1° the angles x between 0° and 180° for which

(a) $\sin 3x = \frac{1}{2}$,

(b) $\sin^2 x = \frac{1}{2} \cos x$.

(12 marks)

Sequences

3. John is given an interest-free loan to buy a second-hand car. He repays the loan in monthly instalments. He repays £20 the first month, £22 the second month and the repayments continue to rise by £2 per month until the loan is repaid.

Given that the final monthly repayment is £114,

(a) show that the number of months it will take John to repay the loan is 48,

(b) find the amount, in pounds, of the loan.

(8 marks)

Graphs & Areas 7.

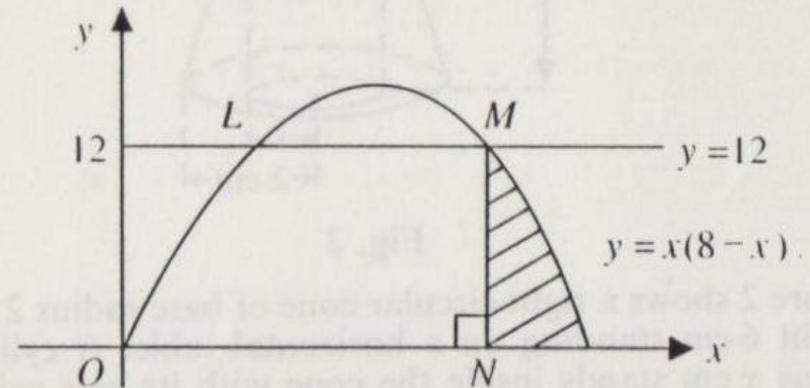


Fig. 1

Figure 1 shows the curve C with equation $y = x(8 - x)$ and the line with equation $y = 12$ which meet at the points L and M .

(a) Determine the coordinates of the point M .

Given that N is the foot of the perpendicular from M onto the x -axis,

(b) calculate the area of the shaded region which is bounded by NM , the curve C and the x -axis.

(10 marks)

Graphs & Gradients

10.

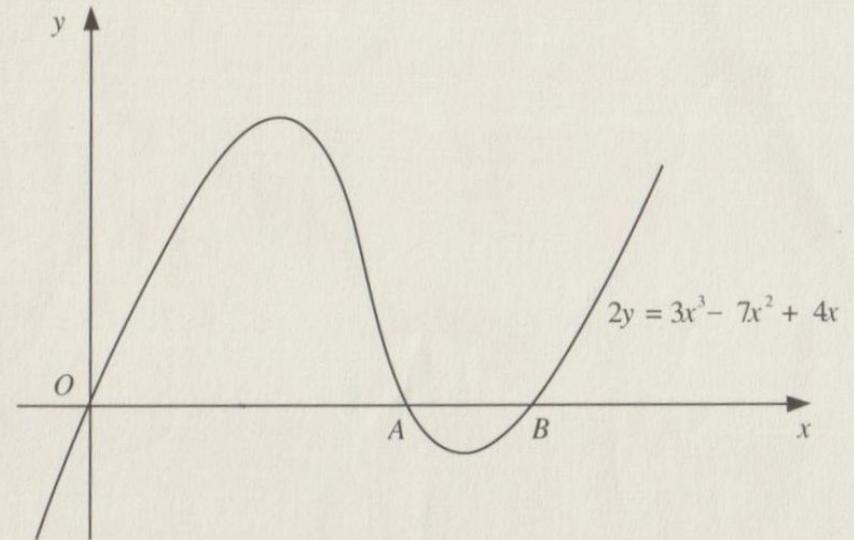


Fig. 2

Figure 2 shows a sketch of part of the curve C with equation

$$2y = 3x^3 - 7x^2 + 4x$$

which meets the x -axis at the origin O , the point $A(1,0)$ and the point B .

(a) Find the coordinates of B .

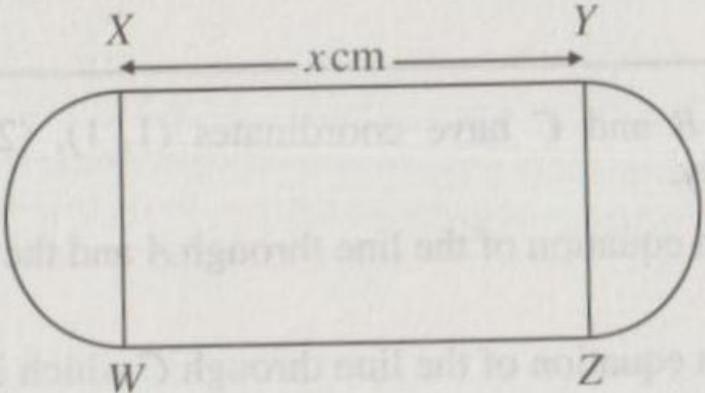
The normals to the curve C at the points O and A meet at the point N .

(b) Find the coordinates of N .

(c) Calculate the area of $\triangle OAN$.

Solving Problems

7. (13 marks)



The diagram shows a tray with a rectangular region $WXYZ$ and semi-circular regions at each end. The length of the rectangle is labeled as x cm. The vertices are labeled X and Y at the top, and W and Z at the bottom. A double-headed arrow above the rectangle indicates its length is x cm.

Fig. 2

Figure 2 shows the flat surface of a tray consisting of a rectangular region $WXYZ$ and a semi-circular region at each end with WX and YZ as diameters.

The rectangle $WXYZ$ has area 200 cm^2 .

(a) Given that $XY = x$ cm, show that the perimeter P cm of the tray is given by the formula

$$P = 2x + \frac{200\pi}{x}.$$

(b) Find the minimum value of P as x varies. (13 marks)

Describing and Comparing Data Sets

The mark x obtained by each of 45 students randomly selected from those students who sat the accountancy examination was recorded. The stem and leaf diagram below summarises the marks.

Mark	(5 3 means 53)	Totals
5	0 1 3 3 4 4	(6)
5	5 6 7 9	(4)
6	1 1 3 3 4 4 4	(7)
6	5 7 8 8 9	(5)
7	3 3 4 4 4 4	(6)
7	5 5 6 6 7 7 7 7 8 8 8 9 9	(13)
8	0 0 1 1	(4)

(b) Using graph paper and showing your scale clearly, construct a box plot to represent these data. (8 marks)

(c) Comment on the skewness of this distribution. (1 mark)

For the above sample, $\Sigma x = 3085$ and $\Sigma x^2 = 215\,569$.

(d) Find the mean and the standard deviation of this sample of marks. (3 marks)

The mean and the standard deviation of the marks of all the students who sat the examination were 65 and 16.5 respectively. The examiners decided that the mark of each student should be scaled by having 10 marks subtracted and then reduced by a further 10%.

(e) Find the mean and the standard deviation of the scaled marks. (5 marks)

Probability

1. The events A and B are mutually exclusive. Given that

$P(A) = 0.4$ and $P(B) = 0.5$ find

(a) $P(A \cap B)$, (1 mark)

(b) $P(A \cup B)$, (2 marks)

(c) $P(A' \cap B)$. (2 marks)

Probability

4. There are 60 students in the sixth form of a certain school. Mathematics is studied by 27 of them, biology by 20 and 22 students study neither mathematics nor biology.
- (a) Find the probability that a randomly selected student studies both mathematics and biology.
- (b) Find the probability that a randomly selected mathematics student does not study biology.
- A student is selected at random.
- (c) Determine whether the event “studying mathematics” is statistically independent of the event “not studying biology”.
- (10 marks)**

Probability Distributions

6. A factory makes steel rods and steel tubes. The internal diameter X of a steel tube is normally distributed with mean 3.50 cm and standard deviation 0.03 cm.

(a) Find the probability that a randomly selected tube has an internal diameter less than 3.48 cm. (3 marks)

The diameter Y of a steel rod is normally distributed with mean 3.45 cm and standard deviation 0.03 cm.

(b) Find the probability that a randomly selected rod has a diameter greater than 3.40 cm and less than 3.51 cm. (3 marks)

Hypothesis Testing

In a manufacturing process 25% of articles are thought to be defective. Articles are produced in batches of 20

- (a) A batch is selected at random. Using a 5% significance level, find the critical region for a two tailed test that the probability of an article chosen at random being defective is 0.25

You should state the probability in each tail which should be as close as possible to 0.025

(5)

The manufacturer changes the production process to try to reduce the number of defective articles. She then chooses a batch at random and discovers there are 3 defective articles.

- (b) Test at the 5% level of significance whether or not there is evidence that the changes to the process have reduced the percentage of defective articles. State your hypotheses clearly.

(5)

Sampling

4 A manufacturer of microswitches is testing the reliability of its switches. It uses a special machine to switch them on and off until they break.

a Give one reason why the manufacturer should use a sample rather than a census.

The company tests a sample of 10 switches, and obtains the following results:

23 150 25 071 19 480 22 921 7 455

b The company claims that its switches can be operated an average of 20 000 times without breaking. Use the sample data above to comment on this claim.

c Suggest one way the company could improve its prediction.

Large Data set

CAMBORNE © Crown Copyright Met Office 2015										
NGR = 1627E 4067N										
Altitude = 87 metres										
Latitude = 50:22N Longitude = 05:33W										
Date	Daily Mean Temperature (0900-0900) (°C)	Daily Total Rainfall (0900-0900) (mm)	Daily Total Sunshine (0000-2400) (hrs)	Daily Mean Windspeed (0000-2400) (kn)	Daily Mean Windspeed (0000-2400) (Beaufort conversion)	Daily Maximum Gust (0000-2400) (kn)	Daily Maximum Relative Humidity %	Daily Mean Total Cloud (oktas)	Daily Mean Visibility (Dm)	
17/05/1987	9.7	tr	0	7	Light	19	93	8	2900	
18/05/1987	10.4	0	4.1	14	Moderate	27	86	6	2300	
19/05/1987	9.5	0	4.4	8	Light	17	96	4	1900	
20/05/1987	11.1	0	11.9	6	Light	15	99	3	1600	
21/05/1987	10.5	0	11.3	12	Moderate	26	87	4	2700	
22/05/1987	11.1	0.3	7.8	11	Moderate	27	87	6	2600	
23/05/1987	9.8	0	10.8	11	Moderate	27	87	4	1400	
24/05/1987	10.2	4.2	5.1	16	Moderate	32	94	6	1000	
25/05/1987	12.6	1.7	10.7	13	Moderate	35	86	6	2500	
26/05/1987	10.4	7.5	0	7	Light	22	95	7	1500	
27/05/1987	11.3	0.1	0	9	Light	21	98	8	500	
28/05/1987	12.1	0	5.5	8	Light	19	96	6	1600	
29/05/1987	12.0	tr	0	7	Light	20	99	7	1500	
30/05/1987	11.6	7.1	0	11	Moderate	28	99	7	900	
31/05/1987	12.7	0	8.6	9	Light	19	98	7	1400	
01/06/1987	12.7	9	0.1	6	Light	16	94	7	1900	
02/06/1987	12.8	3.9	1.4	13	Moderate	29	99	8	1100	
03/06/1987	13.5	3.1	4.1	12	Moderate	25	98	7	1300	
04/06/1987	13.5	0.1	6.6	6	Light	14	96	6	1600	

Objects being pushed & pulled

6.

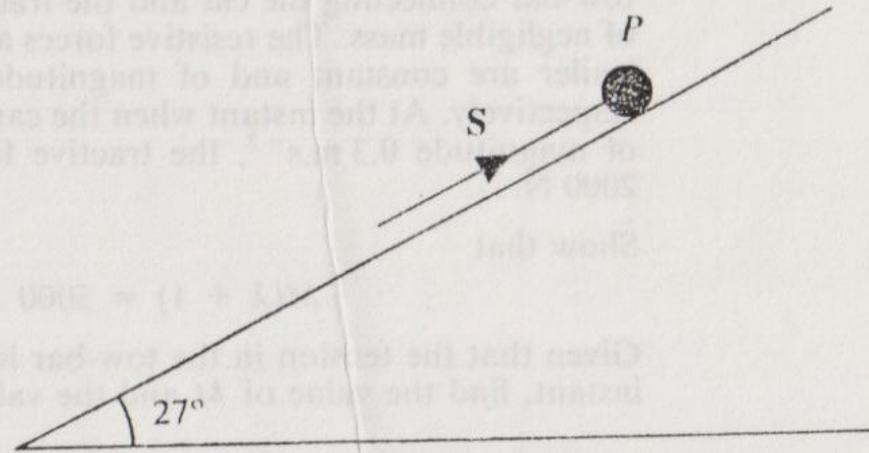


Fig. 1

A small parcel P , of mass 1.5 kg , is placed on a rough plane inclined at an angle of 27° to the horizontal. The coefficient of friction between the parcel and the plane is 0.3 . A force S , of variable magnitude, is applied to the parcel as shown in Fig. 1. The line of action of S is parallel to a line of greatest slope of the inclined plane.

Determine, in N to 1 decimal place, the magnitude of S when the parcel P is in limiting equilibrium and on the point of moving

(a) down the plane,

(b) up the plane.

(12 marks)

Vectors

2. Two horizontal forces, **P** and **Q**, act on a particle.
The force **P** is of magnitude 8 N and acts in the direction whose bearing is 330° .
The force **Q** is of magnitude 15 N and acts in the direction whose bearing is 060° .
Calculate the magnitude and the direction of the resultant of **P** and **Q**, giving the direction as a bearing to the nearest degree. **(6 marks)**

Travel Graphs

3. A car is travelling along a straight motorway at a constant speed $V \text{ m s}^{-1}$. Ten seconds after passing a speed-limit sign, the driver brakes and the car decelerates uniformly for 5 seconds, reducing its speed to 30 m s^{-1} .

(a) Sketch a speed-time graph to illustrate this information.

Given that the car covers a distance of 600 m in the 15 second period, find

(b) the value of V ,

(c) the deceleration of the car.

(8 marks)

Objects in Equilibrium

A beam AB has length 15 m. The beam rests horizontally in equilibrium on two smooth supports at the points P and Q , where $AP = 2$ m and $QB = 3$ m. When a child of mass 50 kg stands on the beam at A , the beam remains in equilibrium and is on the point of tilting about P . When the same child of mass 50 kg stands on the beam at B , the beam remains in equilibrium and is on the point of tilting about Q . The child is modelled as a particle and the beam is modelled as a non-uniform rod.

(a) (i) Find the mass of the beam.

(ii) Find the distance of the centre of mass of the beam from A .

(8)

When the child stands at the point X on the beam, it remains horizontal and in equilibrium. Given that the reactions at the two supports are equal in magnitude,

(b) find AX .

(6)

Velocity and Acceleration

A lorry is moving along a straight horizontal road with constant acceleration. The lorry passes a point A with speed $u \text{ m s}^{-1}$, ($u < 34$), and 10 seconds later passes a point B with speed 34 m s^{-1} . Given that $AB = 240 \text{ m}$, find

(a) the value of u , **(3)**

(b) the time taken for the lorry to move from A to the mid-point of AB . **(6)**

Sort the cards into several
categories.

Be ready to discuss your choices.

These cards were correct:

A D G J

K M P

Can you correct the others?

B

$$4 - 3x \leq 13$$

$$-3x \leq 9$$

$$x \leq -3$$

C

$$x^2 + 7x + 12 = 6$$

$$(x+3)(x+4) = 6$$

$$x+3 = 6$$

$$x = 3$$

or

$$x+4 = 6$$

or

$$x = 2$$

E

$$\begin{aligned}4 - (x + 2) &= 4 - x + 2 \\ &= 6 - x\end{aligned}$$

$$F \quad (x + y)^2 = x^2 + y^2$$

H

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

$$I \quad x^2 > 16$$

$$x > 4 \quad \text{or} \quad x < -4$$

$$\text{i.e.} \quad -4 > x > 4$$

L

$$\frac{1}{4x} = 4x^{-1}$$

N

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

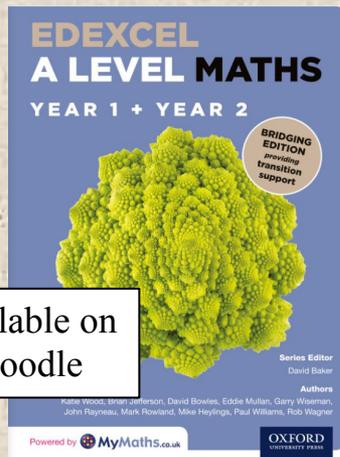
O If $y = x^2 + 3$, find y when $x = -4$

$$y = -4^2 + 3$$

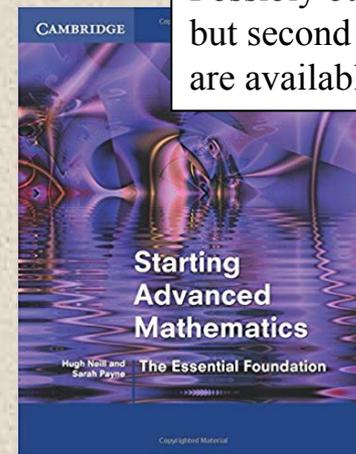
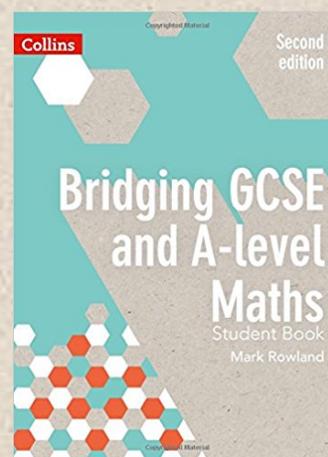
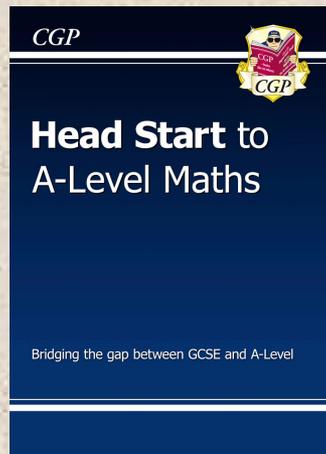
$$= -16 + 3$$

$$= -13$$

If you did not notice all of the mistakes, then you might like to use MyMaths, or another website, or a book specially written to help you to make a good start to A level maths and revise the most important GCSE topics before term starts in September.



Available on Kerboodle



Possibly out of print, but second hand copies are available

Maths for fun

Follow the links to these three Maths sites and spend the day watching Maths videos and trying out some of the activities.
Choose whatever interests you.

<https://www.think-maths.co.uk/>

<https://www.numberphile.com/>

<https://tomrocksmaths.com/>