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Result Number 1

Find the equation of the line through the point (3, -5) which is parallel to the line with equation  $3x + 2y - 5 = 0$ .

**Answer:**  $3x + 2y + 12 = 0$

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 01,  
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Additional Question  
Bank. (#2122).

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Topics in this question:

- Higher Perpendicular and parallel lines

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

Remove this Question from Search Results

Result Number 2

The points A and B have coordinates  $(a, a^2)$  and  $(2b, 4b^2)$  respectively. Determine the gradient of AB in its simplest form.

**Answer:**  $2b + a$

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 02,  
Source: ©Higher Still  
Additional Question  
Bank. (#2123).

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Topics in this question:

- Higher Miscellaneous - not covered by any other subcategory

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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Result Number 3

Show that the vectors  $a = 2i + 3j - k$  and  $b = 3i - j + 3k$  are perpendicular.

**Answer:** Result shown

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 03,  
Source: ©Higher Still  
Additional Question  
Bank. (#2124).

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Topics in this question:

- Higher Perpendicular vectors and the scalar product

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

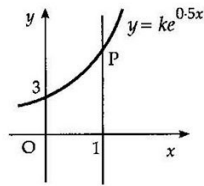
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Result Number 4

Old Higher Maths (1989-2015) 1991 Paper 1, Question 04, Source: ©Higher Still Additional Question Bank. (#2125).

The diagram shows part of the graph of  $y = ke^{0.5x}$ .

- Find the value of  $k$ .
- The line with equation  $x = 1$  intersects the graph at P. Find the coordinates of the point P.



[Click the image for a larger version \(opens in new frame\).](#)

1 **Answer:** (a)  $k = 3$  (b) (1, 4.9)

2 [View full mark scheme \(opens in new frame\).](#)

Topics in this question:

- Higher Graphs of logarithmic or exponential functions
- Higher Miscellaneous - not covered by any other subcategory

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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Result Number 5

Old Higher Maths (1989-2015) 1991 Paper 1, Question 05, Source: ©Higher Still Additional Question Bank. (#2126).

Find the equation of the tangent to the curve  $y = 3x^2 + 2$  at the point where  $x = 1$ .

[Click the image for a larger version \(opens in new frame\).](#)

4 **Answer:**  $y = 6x - 1$

[View full mark scheme \(opens in new frame\).](#)

Topics in this question:

- Higher Equation of a tangent to a curve

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

Remove this Question from Search Results

Result Number 6

Old Higher Maths (1989-2015) 1991 Paper 1, Question 06, Source: ©Higher Still Additional Question Bank. (#2127).

When  $f(x) = 2x^4 - x^3 + px^2 + qx + 12$  is divided by  $(x - 2)$ , the remainder is 114.

One factor of  $f(x)$  is  $(x - 2)$ . Find the values of  $p$  and  $q$ .

[Click the image for a larger version \(opens in new frame\).](#)

**Answer:**  $p = 8, q = 23$

5 [View full mark scheme \(opens in new frame\).](#)

Topics in this question:

- Higher Cubic expressions/equations: when told root or factor, identify coefficients

In the opinion of Dynamic Maths, this question is **non-routine** and **not interleaved**.

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Result Number 7

Old Higher Maths (1989-2015) 1991 Paper 1, Question 07, Source: ©Higher Still

- Show that the points L(-5, 6, -5), M(7, -2, -1) and N(10, -4, 0) are collinear.
- Find the ratio in which M divides LN.

[Click the image for a larger version \(opens in new frame\).](#)

4 **Answer:** 4:1

1 [View full mark scheme \(opens in new frame\).](#)

Additional Question Bank. (#2128).

Topics in this question:

- Higher Collinearity (in 3d or 2d)
- Higher Ratio in which one point divides two others

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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Result Number 8

Old Higher Maths (1989-2015) 1991 Paper 1, Question 08, Source: ©Higher Still Additional Question Bank. (#2129).

Topics in this question:

- Higher Equation of a tangent to a circle at a point

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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Result Number 9

Old Higher Maths (1989-2015) 1991 Paper 1, Question 09, Source: ©Higher Still Additional Question Bank. (#2130).

Topics in this question:

- Higher Identifying/sketching graphs of related functions (non-trigonometric)
- Higher The graph of the derived function

In the opinion of Dynamic Maths, this question is **routine** and **contains interleaved topics**.

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Result Number 10

Old Higher Maths (1989-2015) 1991 Paper 1, Question 10, Source: ©Higher Still Additional Question Bank. (#2131).

Topics in this question:

- Higher Differential equation

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

Remove this Question from Search Results

Result Number 11

Find the equation of the tangent at the point (3, 1) on the circle  $x^2 + y^2 - 4x + 6y - 4 = 0$ .

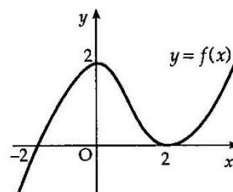
[Click the image for a larger version \(opens in new frame\).](#)

5 **Answer:**  $x + 4y - 7 = 0$

[View full mark scheme \(opens in new frame\).](#)

The diagram shows the graph of  $y = f(x)$ , where  $-2 \leq x \leq 3$ . On separate diagrams, sketch the graphs of

- (a)  $y = -f(x)$ ;  
(b)  $y = f'(x)$ .



[Click the image for a larger version \(opens in new frame\).](#)

**Answer:** graphs sketched

2  
3 [View full mark scheme \(opens in new frame\).](#)

A curve with equation  $y = f(x)$  passes through the point (2, -1) and is such that  $f'(x) = 4x^3 - 1$ . Express  $f(x)$  in terms of  $x$ .

[Click the image for a larger version \(opens in new frame\).](#)

5 **Answer:**  $f(x) = x^4 - x - 15$

[View full mark scheme \(opens in new frame\).](#)

**Answer:** about 54%

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 11,  
Source: ©Higher Still  
Additional Question  
Bank. (#2145).

Topics in this question:

- Higher Miscellaneous - not covered by any other subcategory

In the opinion of Dynamic Maths, this question is **non-routine** and **not interleaved**.

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Result Number 12

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 12,  
Source: ©Higher Still  
Additional Question  
Bank. (#2146).

Topics in this question:

- Higher Apply double angle formula to simplify or evaluate

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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Result Number 13

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 13,  
Source: ©Higher Still  
Additional Question  
Bank. (#2147).

Topics in this question:

- Higher Differentiate or evaluate derivative: composite function

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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Result Number 14

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 14,  
Source: ©Higher Still  
Additional Question  
Bank. (#2148).

Topics in this question:

- Higher Quadratic inequations

In the opinion of Dynamic Maths, this question is **non-routine** and **not interleaved**.

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Result Number 15

On the day of his thirteenth birthday, a boy is given a sum of money to invest and instructions not to withdraw any money until after his eighteenth birthday. The money is invested and compound interest of 9% per annum is added each following birthday. By what percentage will the investment have increased when he withdraws his money just after his eighteenth birthday?

[Click the image for a larger version \(opens in new frame\).](#)

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3

Given that  $\sin A = \frac{3}{4}$ , where  $0 < A < \frac{\pi}{2}$ , find the exact value of  $\sin 2A$ .

[Click the image for a larger version \(opens in new frame\).](#)

3 Answer:  $3\sqrt{7}/8$

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Given that  $f(x) = 5(7 - 2x)^3$ , find the value of  $f'(4)$ .

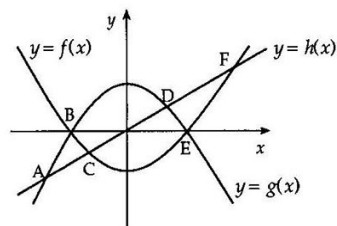
[Click the image for a larger version \(opens in new frame\).](#)

4 Answer:  $-30$

[View full mark scheme \(opens in new frame\).](#)

The diagram shows a rough sketch of the curves  $y = f(x)$ ,  $y = g(x)$  and  $y = h(x)$ . The coordinates are A(-4, 12), B(-2, 0), C(-1, -3), D(1, 3), E(2, 0) and F(4, 12). State the range of values of  $x$  for which

- (a)  $f(x) \leq g(x)$ ;  
(b)  $h(x) < g(x) < f(x)$ .



[Click the image for a larger version \(opens in new frame\).](#)

Answer: (a)  $-2 \leq x \leq 2$  (b)  $-4 < x < -2$

1 [View full mark scheme \(opens in new frame\).](#)  
3 [\(opens in new frame\).](#)

Answer: (a)  $8 - (x + 1)^2$  (b) 8 with

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 15,  
Source: ©Higher Still  
Additional Question  
Bank. (#2149).

Topics in this question:

- Higher Completing the square
- Higher Domain and range

In the opinion of Dynamic Maths,  
this question is **routine** and **not**  
**interleaved**.

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Result Number 16

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 16,  
Source: ©Higher Still  
Additional Question  
Bank. (#2150).

Topics in this question:

- Higher Areas using integration
- Higher Integrate or evaluate definite integral: polynomial

In the opinion of Dynamic Maths,  
this question is **routine** and **not**  
**interleaved**.

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Result Number 17

Old Higher Maths  
(1989-2015) 1991  
Paper 1, Question 17,  
Source: ©Higher Still  
Additional Question  
Bank. (#2151).

Topics in this question:

- Higher Using the distributive law with the scalar product

In the opinion of Dynamic Maths,  
this question is **routine** and **not**  
**interleaved**.

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Result Number 18

Old Higher Maths  
(1989-2015) 1991  
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Source: ©Higher Still  
Additional Question  
Bank. (#2152).

Topics in this question:

- Higher Discriminant and Quadratics

In the opinion of Dynamic Maths,  
this question is **routine** and **not**  
**interleaved**.

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(a) Express  $7 - 2x - x^2$  in the form  $a - (x + b)^2$  and write down the values of  $a$  and  $b$ .

(b) State the maximum value of  $7 - 2x - x^2$  and justify your answer.

[Click the image for a larger version \(opens in new frame\).](#)

2 justification

2 [View full mark scheme \(opens in new frame\).](#)

(a) Find the value  $\int_1^2 (4 - x^2) dx$ .

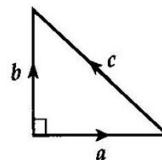
(b) Sketch a graph and shade the area represented by the integral in (a).

[Click the image for a larger version \(opens in new frame\).](#)

3 **Answer:** (a) 5/3 (b) diagram sketched

2 [View full mark scheme \(opens in new frame\).](#)

The diagram shows a right-angled isosceles triangle whose sides are represented by the vectors  $a$ ,  $b$  and  $c$ . The two equal sides have length 2 units. Find the value of  $b \cdot (a + b + c)$



[Click the image for a larger version \(opens in new frame\).](#)

5 **Answer:** 8

5 [View full mark scheme \(opens in new frame\).](#)

Given that  $k$  is a real number, show that the roots of the equation  $kx^2 + 3x + 3 = k$  are always real numbers.

[Click the image for a larger version \(opens in new frame\).](#)

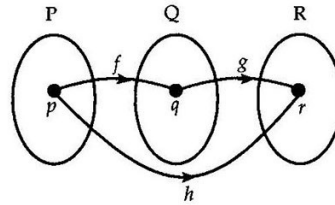
5 **Answer:** result shown

5 [View full mark scheme \(opens in new frame\).](#)

Result Number 19

Old Higher Maths (1989-2015) 1991 Paper 1, Question 19, Source: ©Higher Still Additional Question Bank. (#2153).

The diagram illustrates three functions  $f, g$  and  $h$ . The functions are defined by  $f(x) = 2x + 5$  and  $g(x) = x^2 - 3$ .



The function  $h$  is such that whenever  $f(p) = q$  and  $g(q) = r$  then  $h(p) = r$ .

- (a) If  $q = 7$ , find the values of  $p$  and  $r$ .
- (b) Find a formula for  $h(x)$ , in terms of  $x$ .

**Answer:** (a)  $p = 1, r = 46$  (b)  $h(x) = (2x + 5)^2 - 3$  or equivalent  
2  
2 [View full mark scheme \(opens in new frame\).](#)

Topics in this question:

- Higher Composite functions

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

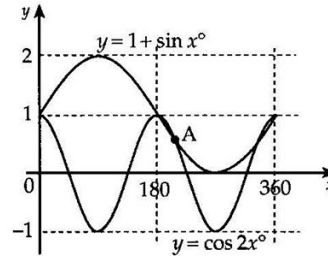
Remove this Question from Search Results

[Click the image for a larger version \(opens in new frame\).](#)

Result Number 20

Old Higher Maths (1989-2015) 1991 Paper 1, Question 20, Source: ©Higher Still Additional Question Bank. (#2154).

The diagram shows two curves with equations  $y = \cos 2x^\circ$  and  $y = 1 + \sin x^\circ$  where  $0 \leq x \leq 360$ .



Find the  $x$ -coordinate of the point of intersection at A.

**Answer:**  $x = 210$   
4 [View full mark scheme \(opens in new frame\).](#)

Topics in this question:

- Higher Solving a trigonometric equation using formula for  $\cos(2x)$

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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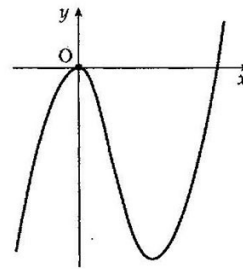
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Result Number 1

Old Higher Maths  
(1989-2015) 1991  
Paper 2, Question 01,  
Source: ©Higher Still  
Additional Question  
Bank. (#2155).

- (a) The diagram shows a part of the curve with equation  $y = 2x^2(x - 3)$ . Find the coordinates of the stationary points on the graph and determine their nature.
- (b) State the range of values of  $k$  for which  $y = k$  intersects the graph in three distinct points.



**Answer:** (a) maximum at (0, 0), minimum at (2, -8) (b)  $-8 < k < 0$

[View full mark scheme](#)  
(5) [\(opens in new frame\)](#).

(2)

Topics in this question:

- Higher Find stationary points and determine nature
- Higher Miscellaneous - not covered by any other subcategory

[Click the image for a larger version \(opens in new frame\)](#).

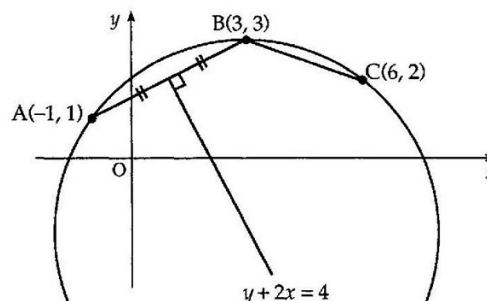
In the opinion of Dynamic Maths, this question is **routine** and contains **interleaved topics**.

Remove this Question from Search Results

Result Number 2

Old Higher Maths  
(1989-2015) 1991  
Paper 2, Question 02,  
Source: ©Higher Still  
Additional Question  
Bank. (#2156).

- (a) In the diagram, A is the point  $(-1, 1)$ , B is  $(3, 3)$  and C is  $(6, 2)$ . The perpendicular bisector of AB has equation  $y + 2x = 4$ . Find the equation of the perpendicular bisector of BC.



**Answer:** (a)  $y = 3x - 11$  (b)  $(x - 3)^2 + (y + 2)^2 = 25$

(4) [View full mark scheme](#)  
[\(opens in new frame\)](#).

(6)

Topics in this question:

- Higher Altitudes, medians, perpendicular bisectors
- Higher Intersection of straight lines
- Higher Circle equation from radius/centre or vice versa
- Higher Miscellaneous - not covered by any other subcategory

- (b) Find the centre and the equation of the circle which passes through A, B and C.

[Click the image for a larger version \(opens in new frame\)](#).

In the opinion of Dynamic Maths, this question is **non-routine** and contains **interleaved topics**.

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Result Number 3

**Answer:** (a) result

Old Higher Maths  
(1989-2015) 1991  
Paper 2, Question 03,  
Source: ©Higher Still  
Additional Question  
Bank. (#2157).

Topics in this question:

- Higher Solving a trigonometric equation using formula for  $\sin(2x)$

In the opinion of Dynamic Maths, this question is **non-routine** and **not interleaved**.

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Result Number 4

Old Higher Maths  
(1989-2015) 1991  
Paper 2, Question 04,  
Source: ©Higher Still  
Additional Question  
Bank. (#2158).

Topics in this question:

- Higher Approximating roots of functions

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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Result Number 5

Old Higher Maths  
(1989-2015) 1991  
Paper 2, Question 05,  
Source: ©Higher Still  
Additional Question  
Bank. (#2183).

Topics in this question:

- Higher Calculating an angle using the scalar product

In the opinion of Dynamic Maths, this question is **non-routine** and **not interleaved**.

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Result Number 6

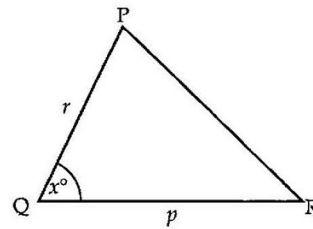
Old Higher Maths  
(1989-2015) 1991  
Paper 2, Question 06,  
Source: ©Higher Still  
Additional Question  
Bank. (#2184).

Topics in this question:

- Higher (Old Higher) Questions where pupils

The diagram shows an isosceles triangle PQR in which  $PR = QR$  and angle  $PQR = x^\circ$ .

- (a) Show that  $\frac{\sin x^\circ}{p} = \frac{\sin 2x^\circ}{r}$ .
- (b) (i) State the value of  $x^\circ$  when  $p = r$ .  
(ii) Using the fact that  $p = r$ , solve the equation in (a) above, to justify your stated value of  $x^\circ$ .



[Click the image for a larger version \(opens in new frame\).](#)

- (a) On the same diagram, sketch the graphs of  $y = \log_{10} x$  and  $y = 2 - x$  where  $0 < x < 5$ .  
Write down an approximation for the  $x$ -coordinate of the point of intersection.
- (b) Find the value of this  $x$ -coordinate, correct to 2 decimal places.

[Click the image for a larger version \(opens in new frame\).](#)

shown (b) (i)  $60^\circ$  (ii)  $x = 60^\circ$

(3) [View full mark scheme \(opens in new frame\).](#)

(5)

**Answer:** (a) sketch complete (b) 1.76

(3) [View full mark scheme \(opens in new frame\).](#)

(3)

Diagram 1 shows a christmas tree decoration which is made of coloured glass rods in the shape of a square-based prism topped by a square pyramid. Diagram 2 shows the decoration relative to the origin and rectangular coordinate axes OX, OY and OZ.

The vertex F has position vector  $\begin{pmatrix} 2 \\ 2 \\ -7 \end{pmatrix}$

and the vertex V has position vector  $\begin{pmatrix} 1 \\ 1 \\ 3 \end{pmatrix}$

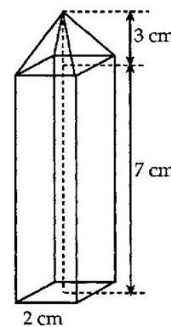


Diagram 1

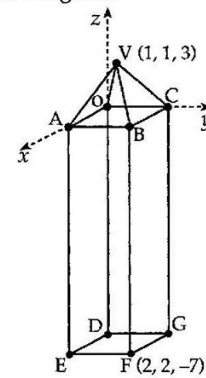


Diagram 2

- (a) Find
- (i) the components of the vectors represented by  $\vec{VF}$  and  $\vec{VE}$ ;  
(ii) the size of angle EVF.
- (b) To make the decoration more attractive, triangular sheets of coloured glass VEF and VDG are added to it.  
Calculate the area of the glass triangle VEF.

(7)

(3)

[Click the image for a larger version \(opens in new frame\).](#)

**Answer:** (a) (i)  $\vec{VF} = (1 \ 1 \ -10)$   $\vec{VE} = (1 \ -1 \ -10)$  [written as columns]  
(a) (ii)  $11.4^\circ$  (b) 10.02 units<sup>2</sup>

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**Answer:**  $3x^2 \cos x - x^3 \sin x$

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In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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There is a rule known as the Product Rule which is used, as shown below, to differentiate any product of two functions of the same variable.

**The Product Rule**

If  $P(x) = f(x).g(x)$ , then  $P'(x) = f'(x).g(x) + f(x).g'(x)$

**Example:** Find the derivative of  $P(x) = x^2 \sin x$ .

$P(x) = x^2 \sin x$       Choose  $f(x) = x^2$  and  $g(x) = \sin^2 x$   
then  $f'(x) = 2x$  and  $g'(x) = \cos x$

so  $P'(x) = 2x \cdot \sin x + x^2 \cdot \cos x$

$P'(x) = 2x \sin x + x^2 \cos x$

Use the Product Rule to find the derivative of  $P(x) = x^3 \cos x$

(5)

[Click the image for a larger version \(opens in new frame\).](#)

- (a) A tractor tyre is inflated to a pressure of 50 units. Twenty-four hours later the pressure has dropped to 10 units.

**Answer:** (a)  $k = 0.067$   
(b) Yes because  $38 > 30$

If the pressure,  $P_t$  units, after  $t$  hours is given by the formula  $P_t = P_0 e^{-kt}$ , find the value of  $k$ , to three decimal places.

[View full mark scheme \(opens in new frame\).](#)

- (b) The tyre manufacturer advises that serious damage to the tyre will result if it is used when the pressure drops below 30 units.

If the farmer inflates the tyre to 50 units and drives the tractor for four hours, can the tractor be driven further without inflating the tyre and without risking serious damage to the tyre?

(4)

[Click the image for a larger version \(opens in new frame\).](#)

The displacement,  $d$  units, of a wave after  $t$  seconds, is given by the formula  $d = \cos 20t^\circ + \sqrt{3} \sin 20t^\circ$ .

**Answer:** (a)  $2\cos(20t - 60)^\circ$  (b) sketch complete (c)  $t = 0.9$ ,  $t = 5.1$

- (a) Express  $d$  in the form  $k \cos(20t - \alpha)^\circ$ , where  $k > 0$  and  $0 \leq \alpha \leq 360$ .
- (b) Sketch the graph of  $d$  for  $0 \leq t \leq 18$ .
- (c) Find, correct to 1 decimal place, the values of  $t$ ,  $0 \leq t \leq 18$ , for which the displacement is 1.5 units.

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[Click the image for a larger version \(opens in new frame\).](#)

(3)

Topics in this question:

- Higher Solving equations where the unknown is in the exponent

In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

Remove this Question from Search Results

Result Number 8

Old Higher Maths (1989-2015) 1991 Paper 2, Question 08, Source: ©Higher Still Additional Question Bank. (#2186).

Topics in this question:

- Higher Wave function ( $y = a \sin x \pm b \cos x$ )
- Higher Identifying/sketching graphs of related functions (trigonometric)
- Higher Basic trig equation (no formulae required) in radians or degrees

In the opinion of Dynamic Maths, this question is **non-routine** and **contains interleaved topics**.

Remove this Question from Search Results

Result Number 9

Old Higher Maths (1989-2015) 1991 Paper 2, Question 09, Source: ©Higher Still Additional Question Bank. (#2187).

Topics in this question:

- Higher Limits of recurrence relations

**Answer:** (a) 23.22 (b) Yes because  $93.4 < 100$

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- Higher Miscellaneous - not covered by any other subcategory
- Higher Write a recurrence relation formula from a real-life situation

In the opinion of Dynamic Maths, this question is **non-routine** and **not interleaved**.

Remove this Question from Search Results

### Result Number 10

Old Higher Maths (1989-2015) 1991 Paper 2, Question 10, Source: ©Higher Still Additional Question Bank. (#2188).

#### Topics in this question:

- Higher Identify polynomial equation when shown graph/roots
- Higher Points of intersection of polynomial(s) and/or straight line

In the opinion of Dynamic Maths, this question is **non-routine** and **contains interleaved topics**.

Remove this Question from Search Results

### Result Number 11

Old Higher Maths (1989-2015) 1991 Paper 2, Question 11, Source: ©Higher Still Additional Question Bank. (#2189).

#### Topics in this question:

- Higher Equation of a tangent to a curve
- Higher Areas using integration

In the opinion of Dynamic Maths, this question is **non-routine** and **contains interleaved topics**.

Remove this Question from Search Results

- (a) At 12 noon a hospital patient is given a pill containing 50 units of antibiotic.  
By 1 pm the number of units in the patient's body has dropped by 12%.  
By 2 pm a further 12% of the units remaining in the body at 1 pm is lost.  
If this fall-off rate is maintained, find the number of units of antibiotic remaining at 6 pm. (4)
- (b) A doctor considers prescribing a course of treatment which involves a patient taking one of these pills every 6 hours over a long period of time. The doctor knows that more than 100 units of this antibiotic in the body is regarded as too dangerous. Should the doctor prescribe this course of treatment? Give reasons for your answer. (6)

[Click the image for a larger version \(opens in new frame\).](#)

Diagram 1 shows a rectangular plate of transparent plastic moulded into a parabolic shape and pegged to the ground to form a cover for growing plants. Triangular metal frames are placed over the cover to support it and prevent it blowing away in the wind. Diagram 2 shows an end view of the cover and the triangular frame related to the origin O and axes Ox and Oy. (All dimensions are given in centimetres.)

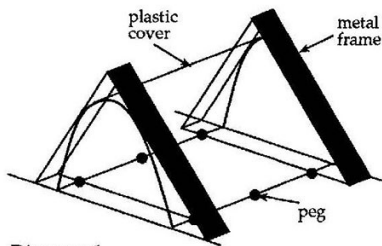


Diagram 1

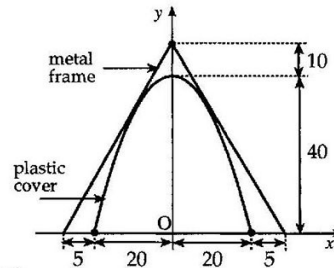
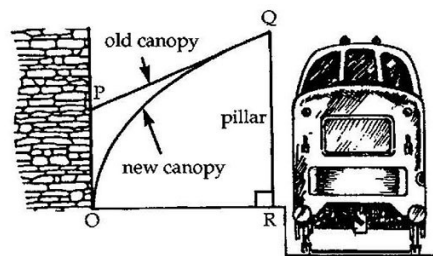


Diagram 2

- (a) Show that the equation of the parabolic end is  $y = 40 - \frac{x^2}{100}$ ,  $-20 \leq x \leq 20$ . (4)
- (b) Show that the triangular frame touches the cover without disturbing the parabolic shape. (7)

[Click the image for a larger version \(opens in new frame\).](#)

The diagram shows a proposed replacement of the old platform canopy at the local railway station by a new parabolic canopy, while keeping the original pillars. If OR and OP are taken as the x- and y- axes and Q has coordinates (1, 1), then OQ has equation  $y = \sqrt{x}$  and PQ is the tangent at Q to the parabola.



**Answer:** (a)  $y = \frac{1}{2}x + \frac{1}{2}$  P(0, 1/2) (b)  $\frac{3}{4}$  (c)  $\frac{2}{3}$  (d) Correct because  $11.1\% > 10\%$

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The planners have received an objection that there is a reduction of more than 10% in the space under the canopy and wish to compare the two canopies.

- (a) Find the equation of the tangent PQ and the coordinates of P. (5)
- (b) Find the area of the trapezium OPQR. (2)
- (c) Find the area under the parabola OQ. (3)
- (d) Comment on the objection received. (3)

[Click the image for a larger version \(opens in new frame\).](#)