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Result Number 1

Old Higher Maths (1989-2015) 1989 Paper 1, Question 01, Source: ©Higher Still Additional Question Bank. (#2050).

The vertices of a triangle are P(–1, –1), Q(2, 1) and R(–6, 2). Find the equation of the altitude of triangle PQR, drawn from P.

3

Click the image for a larger version (opens in new frame).

Answer: y = 8x + 7

View full mark scheme (opens in new frame).

Topics in this question:

- Higher Altitudes, medians, perpendicular bisectors

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

Remove this Question from Search Results

Result Number 2

Old Higher Maths (1989-2015) 1989 Paper 1, Question 02, Source: ©Higher Still Additional Question Bank. (#2051).

Factorise fully $2x^3 + 5x^2 - 4x - 3$.

4

Click the image for a larger version (opens in new frame).

Answer: (x − 1)(2x + 1)(x + 3)

View full mark scheme (opens in new frame).

Topics in this question:

- Higher Cubic expressions/equations: factorise or solve

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

Remove this Question from Search Results

Result Number 3

Old Higher Maths (1989-2015) 1989 Paper 1, Question 03, Source: ©Higher Still Additional Question Bank. (#2052).

The vectors p, q and r are defined as follows:

$$p = 3i - 3j + 2k, \quad q = 4i - j + k, \quad r = 4i - 2j + 3k.$$

(a) Find $2p - q + r$ in terms of i, j and k.

(b) Find the value of $|2p - q + r|$.

1

2

Click the image for a larger version (opens in new frame).

Answer: (a) 6i − 7j + 6k (b) 11

View full mark scheme (opens in new frame).

Result Number 4

Old Higher Maths (1989-2015) 1989 Paper 1, Question 04, Source: ©Higher Still Additional Question Bank. (#2053).

PQRS is a parallelogram with vertices P(1, 3, 3), Q(4, –2, –2) and R(3, 1, 1). Find the coordinates of S.

Click the image for a larger version (opens in new frame).

Answer: (0,6,6)

3

View full mark scheme (opens in new frame).

Result Number 5

Old Higher Maths (1989-2015) 1989 Paper 1, Question 05, Source: ©Higher Still Additional Question Bank. (#2054).

Find $\int \left(2x^2 + 3\right) dx$.

Click the image for a larger version (opens in new frame).

Answer: (2/3)x³ + 3x + C

3

View full mark scheme (opens in new frame).

Result Number 6

Old Higher Maths (1989-2015) 1989 Paper 1, Question 06, Source: ©Higher Still Additional Question Bank. (#2055).

A(4, 4, 10), B(–2, –4, 12) and C(–8, 0, 10) are the vertices of a right-angled triangle. Determine which angle of the triangle is the right angle.

Click the image for a larger version (opens in new frame).

Answer: ABC

3

View full mark scheme (opens in new frame).

Result Number 7

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

Solve $2\sin 3x° - 1 = 0$ for $0 \le x \le 180$.

Click the image for a larger version (opens in new frame).

4 **Answer:** x = 10, 50, 130

View full mark scheme (opens in new frame).

Additional Question Bank. (#2056).

Result Number 8

Old Higher Maths (1989-2015) 1989 Paper 1, Question 08, Source: ©Higher Still Additional Question Bank. (#2057).

Express $x^2 + 6x + 11$ in the form $(x+a)^2 + b$ and hence state the maximum value of $\dfrac{1}{x^2 + 6x + 11}$.

4

Click the image for a larger version (opens in new frame).

Answer: ½

View full mark scheme (opens in new frame).

Result Number 9

Old Higher Maths (1989-2015) 1989 Paper 1, Question 09, Source: ©Higher Still Additional Question Bank. (#2058).

The sides of this equilateral triangle are 2 units long and represent the vectors a, b and c as shown. Evaluate $a.(a+b+c)$.

5
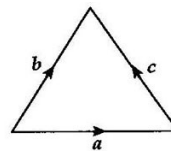
Click the image for a larger version (opens in new frame).

Answer: 4

View full mark scheme (opens in new frame).

Result Number 10

Old Higher Maths (1989-2015) 1989 Paper 1, Question 10, Source: ©Higher Still Additional Question Bank. (#2059).

Differentiate $\sin 2x + \dfrac{2}{\sqrt{x}}$ with respect to x.

4

Click the image for a larger version (opens in new frame).

Answer: 2cos2x – x^(–3/2)

View full mark scheme (opens in new frame).

Result Number 11

Old Higher Maths (1989-2015) 1989 Paper 1, Question 11,

Answer: (a² – b²)/(a² + b²)

View full mark scheme (opens in new frame).

Topics in this question:

- Higher Apply compound angle formula to simplify or evaluate

In the diagram, A and B have coordinates as shown.

Express $\sin A\hat{O}B$ in terms of a and b.

4

Click the image for a larger version (opens in new frame).

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

Remove this Question from Search Results

Result Number 12
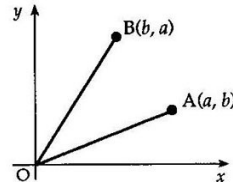
Old Higher Maths (1989-2015) 1989 Paper 1, Question 12, Source: ©Higher Still Additional Question Bank. (#2061).

Topics in this question:

- Higher Differentiate or evaluate derivative: polynomial

If $y = x^2 - x$, show that $\dfrac{dy}{dx} = 1 + \dfrac{2y}{x}$.

Click the image for a larger version (opens in new frame).

3

Answer: result shown

View full mark scheme (opens in new frame).

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

Remove this Question from Search Results

Result Number 13

Old Higher Maths (1989-2015) 1989 Paper 1, Question 13, Source: ©Higher Still Additional Question Bank. (#2062).

Topics in this question:

- Higher Angles and straight lines: m = tanθ

Calculate, to the nearest degree, the angle between the x-axis and the tangent to the curve with equation $y = x^3 - 4x - 5$ at the point where $x = 2$.

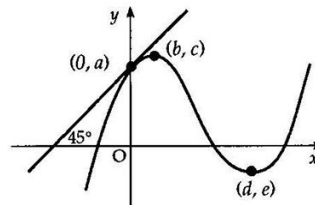Click the image for a larger version (opens in new frame).

4

Answer: 83°

View full mark scheme (opens in new frame).

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

Remove this Question from Search Results

Result Number 14

Old Higher Maths (1989-2015) 1989 Paper 1, Question 14, Source: ©Higher Still Additional Question Bank. (#2074).

Topics in this question:

- Higher The graph of the derived function
- Higher Angles and straight lines: m = tanθ
- Higher Miscellaneous - not covered by any other subcategory

The diagram shows the graph of a cubic function with a maximum at (b, c) and a minimum at (d, e). The tangent at $(0, a)$ is inclined at 45° to the x-axis.

(a) State the values of $f'(b)$, $f'(d)$ and $f'(0)$.
(b) Sketch the graph of the the derived function f'.

Click the image for a larger version (opens in new frame).

2
2

Answer: (a) f´(b) = 0, f´(d) = 0, f´(0) = 1 (b) sketch complete and annotated

View full mark scheme (opens in new frame).

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

Remove this Question from Search Results

Result Number 15

Answer: t = pi/8, t =

Find the values of t, where $0 < t < 2\pi$, for which $4\cos\left(2t - \frac{\pi}{4}\right)$ has its maximum value.

4

9pi/8

Click the image for a larger version (opens in new frame).

Find the value of $\int_{1}^{2} \frac{u^2 + 2}{2u^2}\, du$.

5

Answer: 1

The diagram shows a sketch of the graph of $y = \log_2 x$.
Make a rough copy of the diagram.
On your copy, sketch the graph of $y = \log_2 2x$.
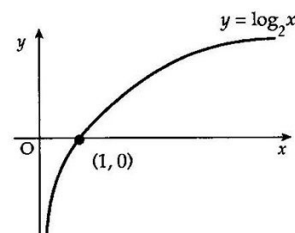
3

Answer: sketch complete

Click the image for a larger version (opens in new frame).

Find the possible values of k for which the line $x - y = k$ is a tangent to the circle $x^2 + y^2 = 18$.

5

Answer: $k = \pm 6$

Click the image for a larger version (opens in new frame).

Result Number 19

Old Higher Maths (1989-2015) 1989 Paper 1, Question 19, Source: ©Higher Still Additional Question Bank. (#2079).

Functions f and g are defined by $f(x) = 2x + 3$ where $x \in \mathbf{R}$ and $g(x) = \dfrac{x^2 + 25}{x^2 - 25}$ where $x \in \mathbf{R}, x \neq 5$.

The function h is given by the formula $h(x) = g(f(x))$.
For which real values of x is the function h **undefined**?

4

Answer: x = 1, x = −4

View full mark scheme (opens in new frame).

Click the image for a larger version (opens in new frame).

Topics in this question:

- Higher Domain and range
- Higher Composite functions

Result Number 20

Old Higher Maths (1989-2015) 1989 Paper 1, Question 20, Source: ©Higher Still Additional Question Bank. (#2080).

Medical researchers studying the growth of a strain of bacteria observe that the number of bacteria, present after t hours, is given by the formula $N(t) = 40e^{1 \cdot 5t}$.

(a) State the number of bacteria present at the start of the experiment.
(b) How many minutes will the bacteria take to double in number?

1
4

Answer: (a) 40 (b) 28 minutes

View full mark scheme (opens in new frame).

Click the image for a larger version (opens in new frame).

Topics in this question:

- Higher Solving equations where the unknown is in the exponent

Result Number 21

Old Higher Maths (1989-2015) 1989 Paper 1, Question 21, Source: ©Higher Still Additional Question Bank. (#2081).

Two sound intensities P_1 and P_2 are said to differ by n decibels when $n = 10 \log_{10}\left(\dfrac{P_2}{P_1}\right)$

where P_1 and P_2 are measured in phons and $P_2 > P_1$.
Rustling leaves have a typical sound intensity of 30 phons.
If the sound intensity of a fire alarm siren is 6·5 decibels greataer than rustling leaves, what is the sound intensity of the fire alrm system, measured in phons?

3

Answer: 134 phons

View full mark scheme (opens in new frame).

Click the image for a larger version (opens in new frame).

Topics in this question:

- Higher Solving equations containing a logarithm

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Result Number 1

Old Higher Maths (1989-2015) 1989 Paper 2, Question 01, Source: ©Higher Still Additional Question Bank. (#2082).

A function f is defined by the formula $f(x) = 4x^2(x-3)$ where $x \in \mathbf{R}$.

(a)   Write down the coordinates of the points where the curve with equation $y = f(x)$ meets the x- and y-axes. **(2)**

(b)   Find the stationary points of $y = f(x)$ and determine the nature of each. **(6)**

(c)   Sketch the curve $y = f(x)$. **(2)**

(d)   Find the area completely enclosed by the curve $y = f(x)$ and the x-axis. **(4)**

Click the image for a larger version (opens in new frame).

Answer: (a) (0, 0) (3, 0) (b) maximum at (0, 0) minimum at (2, −16) (c) sketch complete (d) 27 units²

View full mark scheme (opens in new frame).

Topics in this question:

- Higher Find stationary points and determine nature
- Higher Sketch a polynomial using calculus
- Higher Areas using integration

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) 1989 Paper 2, Question 02, Source: ©Higher Still Additional Question Bank. (#2083).

ABCD is a quadrilateral with vertices A(4, −1, 3), B(8, 3, −1), C(0, 4, 4) and D(−4, 0, 8).

(a)   Find the coordinates of M, the midpoint of AB. **(1)**

(b)   Find the coordinates of the point T, which divides CM in the ratio 2:1. **(3)**

(c)   Show that B, T and D are collinear and find the ratio in which T divides BD. **(4)**

Click the image for a larger version (opens in new frame).

Answer: (a) (6, 1, 1) (b) result shown (c) 1:2

View full mark scheme (opens in new frame).

Topics in this question:

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

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

Remove this Question from Search Results

Result Number 3

Old Higher Maths (1989-2015) 1989 Paper 2, Question 03,

Answer: (a) sketches complete (b) 3 roots (c) 2·53

Topics in this question:

- Higher Approximating roots of functions

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

Remove this Question from Search Results

Result Number 4

Old Higher Maths (1989-2015) 1989 Paper 2, Question 04, Source: ©Higher Still Additional Question Bank. (#2085).

Topics in this question:

- Higher Identifying/sketching graphs of related functions (non-trigonometric)
- Higher Quadratic inequations
- Higher Identify polynomial equation when shown graph/roots
- Higher Composite functions

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

Remove this Question from Search Results

Result Number 5

Old Higher Maths (1989-2015) 1989 Paper 2, Question 05, Source: ©Higher Still Additional Question Bank. (#2086).

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**.

Remove this Question from Search Results

Result Number 6

Old Higher Maths (1989-2015) 1989 Paper 2, Question 06, Source: ©Higher Still Additional Question Bank. (#2087).

Topics in this question:

(a) (i) Make a sketch of the graph of $y = x^3$, where $-3 \leq x \leq 3$, $x \in \mathbb{R}$.

(ii) On the same diagram, draw the graph of $y = 6x + 1$. **(3)**

(b) State the number of roots which the equation $x^3 = 6x + 1$ has in the interval $-3 \leq x \leq 3$. **(1)**

(c) Calculate the value of the positive root, correct to 3 significant figures. **(4)**

Click the image for a larger version (opens in new frame).

The diagram shows a sketch of the parabola $y = f(x)$.
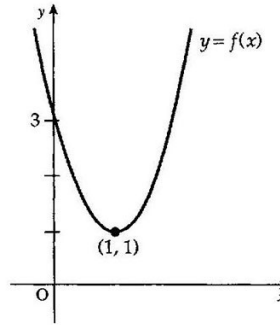
(a) Copy the sketch of $y = f(x)$. On your diagram, draw the parabola with equation $y = -f(x) + 3$. **(4)**

(b) State the values of x for which $3 - f(x) \geq 0$. **(2)**

(c) If $g(x) = 3 - f(x)$, express $g(x)$ in terms of x. **(3)**

Click the image for a larger version (opens in new frame).

An ear-ring is to be made from silver wire and is designed in the shape of two touching circles with two tangents to the outer circle as shown in Diagram 1.
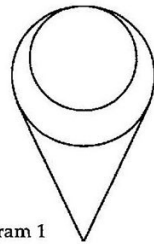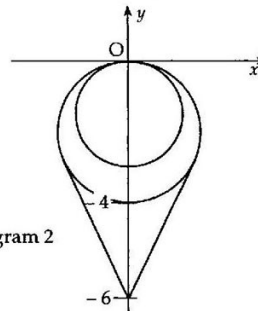

Diagram 1   Diagram 2

Diagram 2 shows a drawing of this ear-ring related to the coordinate axes.

The circles touch at $(0, 0)$.

The equation of the inner circle is $x^2 + y^2 + 3y = 0$.

The outer circle intersects the y-axis at $(0, -4)$.

The tangents meet the y-axis at $(0, -6)$.

Find the total length of silver wire required to make this ear-ring. **(6)**

Click the image for a larger version (opens in new frame).

Some environmentalists are concerned that the presence of chemical nitrates in drinking water presents a threat to health.

The World Health Organisation recommends an upper limit of 50 milligrams per litre (mg/l) for nitrates in drinking water, although it regards levels up to 100 mg/l as safe.

A sub-committee of a Local Water Authority is considering a proposal affecting a small loch which supplies a nearby town with drinking water. The proposal is that a local factory be permitted to make a once-a-week discharge of effluent into the loch, provided that a cleaning treatment of the loch is carried out before each discharge of effluent.

The Water Engineer has presented the following data:

1. The present nitrate level in the loch is 20 mg/l.
2. The cleaning treatment removes 55% of the nitrates from the loch.
3. Each discharge of effluent will result in an addition of 26 mg/l to the nitrate presence in the loch.

and advises the sub-committee that the proposal presents no long-term danger from nitrates to the drinking water supply.

(a) Show the calculations you would use to check the engineer's advice. (5)

(b) Is the engineer's advice acceptable? (1)

Click the image for a larger version (opens in new frame).

Diagram 1 is an artist's impression of a new warehouse based on the architect's plans. The warehouse is in the shape of a cuboid and is supported by three identical parabolic girders spaced 30 metres apart.

With coordinate axes as shown in Diagram 2, the shape of each girder can be described by the equation $y = 9 - \frac{1}{4}x^2$.

Answer: (a) result shown (b) maximum volume 1440sqrt3 when x = 2sqrt3

View full mark scheme (opens in new frame).
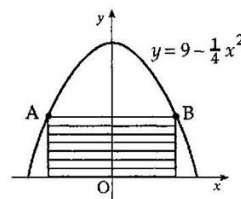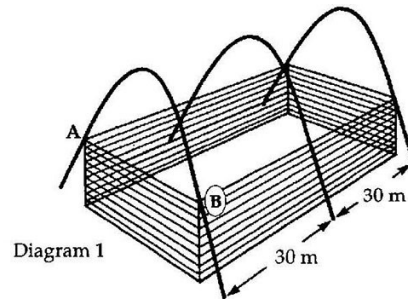
(a) Given that AB is $2x$ metres long, show that the shaded area in Diagram 2 is $\left(18x - \frac{1}{2}x^2\right)$ square metres. (2)

(b) The architect wished to fit into the girders the cuboidal warehouse which had the maximum volume. Find the value of this maximum volume. (6)

Click the image for a larger version (opens in new frame).

A function f is **EVEN** if $f(-x) = f(x)$

e.g. when $f(x) = x^2$, f is **EVEN** because $f(-x) = (-x)^2 = x^2 = f(x)$.

A function f is **ODD** if $f(-x) = -f(x)$

e.g. when $f(x) = x^3$, f is **ODD** because $f(-x) = (-x)^3 = -x^3 = -f(x)$.

(a) Given that $g(x) = \cos x$ and $h(x) = \sin 2x$, decide for each of the functions g and h whether it is **EVEN** or **ODD**. Justify your decisions. (4)

(b) Evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos x \ dx$ and $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin 2x \ dx$. (5)

(c) On separate diagrams, draw rough sketches of the graphs of $y = \cos x$ and $y = \sin 2x$ for $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$. (2)

(d) If $v(x) = x\cos x$, check whether the function v is **EVEN** or **ODD** and suggest a value for $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x\cos x \ dx$. (2)

Answer: (a) g is even, h is odd. With explanations (b) 2, 0 (c) sketches drawn (d) odd, 0

View full mark scheme (opens in new frame).

Click the image for a larger version (opens in new frame).

Result Number 9

Answer: (a) kcos(30t −

The formula $d = 200 + 80(\cos 30t° + \sqrt{3}\sin 30t°)$ gives an approximation to the depth of water, d, measured in centimetres, in a harbour t hours after midnight.

(a) Express $f(t) = \cos 30t° + \sqrt{3}\sin 30t°$ in the form $k\cos(30t - \alpha)°$ and state the values of k and α, where $0 \le \alpha \le 360$. **(4)**

(b) (i) Use your result from part (a) to help you sketch the graph of $f(t)$ for $0 \le t \le 12$.

(ii) Hence, on a separate diagram, sketch the graph of d for $0 \le d \le 12$. **(6)**

(c) What is the "low-water" time at the harbour during the time interval shown on your graph? **(1)**

(d) If the local fishing fleet needs at least 1·5 metres depth of water to enter the harbour without risk of running aground, between what hours must it avoid entering the harbour during the time interval shown on your graph? **(2)**
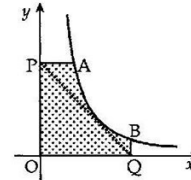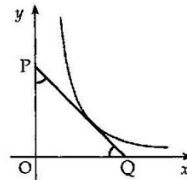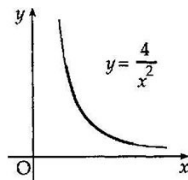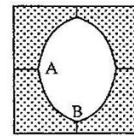
Click the image for a larger version (opens in new frame).

The makers of "OLO", the square mint with the not-so-round hole, commissioned an advertising agency to prepare an illustration to the specification described in (i) to (iii) below. The finished illustration will look like the diagram on the right.

(i) The curve AB in the finished illustration is part of the curve with equation $y = \dfrac{4}{x^2}$.

(ii) A tangent to this curve, making equal angles with both axes, is to be drawn as shown (line PQ).

(iii) Straight lines perpendicular to the axes are to be drawn from P and Q as shown. The shaded part forms $\frac{1}{4}$ of the finished illustration.

(a) State the gradient of PQ and hence find the point of contact of the tangent PQ with the curve. **(5)**

(b) Find the equation of PQ and the coordinates of A and B. **(4)**

(c) Calculate the shaded area of the finished illustration. **(6)**

Click the image for a larger version (opens in new frame).