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Result Number 1

Find p if $(x + 3)$ is a factor of $x^3 - x^2 + px + 15$

3 **Answer:** $p = -7$

Old Higher Maths
(1989-2015) 1990
Paper 1, Question 01,
Source: ©Higher Still
Additional Question
Bank. (#2092).

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

[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 **routine** and **not interleaved**.

Remove this Question from Search Results

Result Number 2

Find the equation of the tangent to the curve $y = 4x^3 - 2$ at the point where $x = -1$.

4 **Answer:** $y = 12x + 6$

Old Higher Maths
(1989-2015) 1990
Paper 1, Question 02,
Source: ©Higher Still
Additional Question
Bank. (#2093).

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

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Topics in this question:

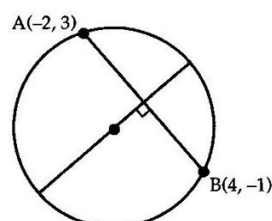
- Higher Equation of a tangent to a curve

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

Remove this Question from Search Results

Result Number 3

A circle passes through $A(-2, 3)$ and $B(4, -1)$. Find the equation of the perpendicular to the chord AB .



4 **Answer:** $3x - 2y - 1 = 0$

Old Higher Maths
(1989-2015) 1990
Paper 1, Question 03,
Source: ©Higher Still
Additional Question
Bank. (#2094).

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

Topics in this question:

- Higher Altitudes, medians, perpendicular bisectors
- 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 4

Old Higher Maths (1989-2015) 1990 Paper 1, Question 04, Source: ©Higher Still Additional Question Bank. (#2095).

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 5

Old Higher Maths (1989-2015) 1990 Paper 1, Question 05, Source: ©Higher Still Additional Question Bank. (#2096).

Topics in this question:

- Higher Basic 3d coordinates (now in N5 maths)
- Higher Basic vector magnitude (now in N5 maths)

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

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Result Number 6

Old Higher Maths (1989-2015) 1990 Paper 1, Question 06, Source: ©Higher Still Additional Question Bank. (#2097).

Topics in this question:

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

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

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Result Number 7

Old Higher Maths

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

Show that P(2, 2, 3), Q(4, 4, 1) and R(5, 5, 0) are collinear and find the ratio in which Q divides PR.

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

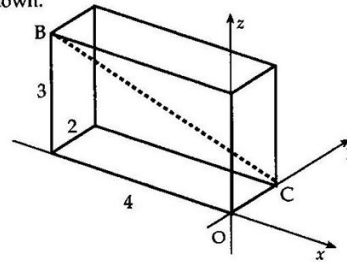
4 Answer: 2:1

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

A cuboid crystal is placed relative to the coordinate axes as shown.

(a) Write down \vec{BC} in component form.

(b) Calculate $|\vec{BC}|$.



Answer: (a) $\begin{pmatrix} 4 \\ 2 \\ -3 \end{pmatrix}$ written as a column vector (b) $\sqrt{29}$

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

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

Evaluate $\int_1^2 (3x^2 + 4) dx$ and draw a sketch to illustrate the area represented by this integral.

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

5 Answer: 11, with sketch

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

Answer: $(x - 5)^2 + (y - 13)^2 = 9$

(1989-2015) 1990
Paper 1, Question 07,
Source: ©Higher Still
Additional Question
Bank. (#2098).

Topics in this question:

- Higher Circle equation from radius/centre or vice versa

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

Remove this Question from Search Results

Result Number 8

Old Higher Maths
(1989-2015) 1990
Paper 1, Question 08,
Source: ©Higher Still
Additional Question
Bank. (#2099).

Topics in this question:

- Higher Differential equation

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) 1990
Paper 1, Question 09,
Source: ©Higher Still
Additional Question
Bank. (#2100).

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 10

Old Higher Maths
(1989-2015) 1990
Paper 1, Question 10,
Source: ©Higher Still
Additional Question
Bank. (#2101).

Topics in this question:

- Higher Identifying/sketching graphs of related functions (trigonometric)
- Higher Basic trig equation (no formulae required) in radians or degrees

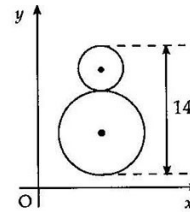
In the opinion of Dynamic Maths, this question is **routine** and **not interleaved**.

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Result Number 11

A bakery firm makes gingerbread men each 14cm high with a circular "head" and "body".

The equation of the "body" is $x^2 + y^2 - 10x - 12y + 45 = 0$ and the line of centres is parallel to the y -axis. Find the equation of the "head".



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

For all points on the curve $y = f(x)$, $f'(x) = 1 - 2x$.

If the curve passes through the point (2, 1), find the equation of the curve.

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

Given that $\cos D = \frac{2}{\sqrt{5}}$ and $0 < D < \frac{\pi}{2}$, find the exact values of $\sin D$ and $\cos 2D$.

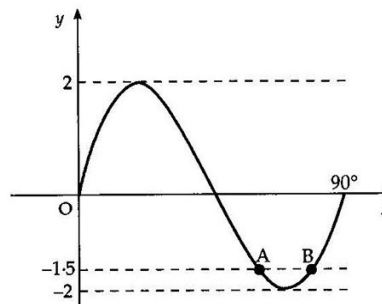
Click the image for a larger version (opens in new frame).

The diagram shows the graph of a sine function from 0° to 90° .

(a) State the equation of the graph.

(b) The line with equation $y = -1.5$ intersects the curve at A and B.

Find the coordinates of A and B.



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

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

5

Answer: $y = 3 + x - 4x^2$

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

Answer: $\sin D = \frac{1}{\sqrt{5}}$, $\cos 2D = \frac{3}{5}$

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

Answer: (a) $y = 2\sin 4x$ (b) (57.1, -1.5) (77.9, -1.5)

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Answer: sketch

Old Higher Maths
(1989-2015) 1990
Paper 1, Question 11,
Source: ©Higher Still
Additional Question
Bank. (#2102).

Topics in this question:

- Higher The graph of the derived function

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

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from Search Results

Result Number 12

Old Higher Maths
(1989-2015) 1990
Paper 1, Question 12,
Source: ©Higher Still
Additional Question
Bank. (#2103).

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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from Search Results

Result Number 13

Old Higher Maths
(1989-2015) 1990
Paper 1, Question 13,
Source: ©Higher Still
Additional Question
Bank. (#2104).

Topics in this question:

- Higher Areas using integration
- Higher Points of intersection of polynomial(s) and/or straight line

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

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Result Number 14

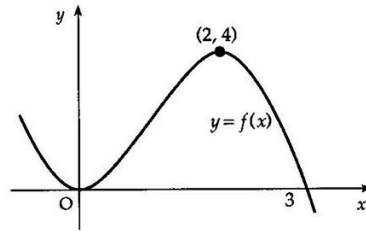
Old Higher Maths
(1989-2015) 1990
Paper 1, Question 14,
Source: ©Higher Still
Additional Question
Bank. (#2105).

Topics in this question:

- Higher Deriving relationship $y = ab^x$ or $y = ax^b$ from straight line

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

The diagram shows a sketch of a cubic function f with stationary points at $(0, 0)$ and $(2, 4)$. Sketch the graph of the derived function f' .



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

The vector $ai + bj + k$ is perpendicular to both the vectors $i - j + k$ and $-2i + j + k$. Find the values of a and b .

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

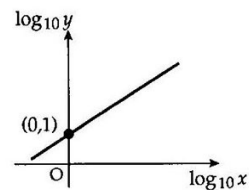
- (a) Find the coordinates of the points of intersection of the curves with equations $y = 2x^2$ and $y = 4 - 2x^2$.
- (b) Find the area completely enclosed between these two curves.

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

As shown in the diagram, a set of experimental results gives a straight line graph when $\log_{10} y$ is plotted against $\log_{10} x$. The straight line passes through $(0, 1)$ and has a gradient of 2.

Express y in terms of x .

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



complete

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

Answer: $a = 2, b = 3$

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

Answer: (a) $(1, 2)$ $(-1, 2)$ (b) $16/3$ units²

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

Answer: $y = 10x^2$

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

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Result Number 15

Old Higher Maths (1989-2015) 1990 Paper 1, Question 15, Source: ©Higher Still Additional Question Bank. (#2106).

Topics in this question:

- Higher Basic trig equation (no formulae required) in radians or degrees

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) 1990 Paper 1, Question 16, Source: ©Higher Still Additional Question Bank. (#2107).

Topics in this question:

- Higher Increasing/decreasing: show that, or find values for which
- Higher Quadratic inequations

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

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Result Number 17

Old Higher Maths (1989-2015) 1990 Paper 1, Question 17, Source: ©Higher Still Additional Question Bank. (#2108).

Topics in this question:

- Higher Graphs of logarithmic or exponential functions

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) 1990 Paper 1, Question 18, Source: ©Higher Still Additional Question Bank. (#2109).

Topics in this question:

- Higher Discriminant and Quadratics

Solve the equation $2\cos^2 x = \frac{1}{2}$, for $0 \leq x \leq \pi$.

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

3 **Answer:** $x = \pi/3, x = 2\pi/3$

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

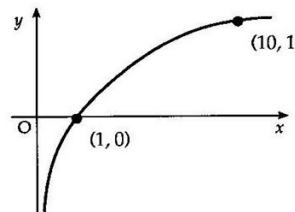
For what values of x is the function $f(x) = \frac{1}{3}x^3 - 2x^2 - 5x - 4$ increasing?

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

5 **Answer:** $x < -1, x > 5$

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

Make a copy of this graph of $y = \log_{10} x$.
On your copy, sketch the graph of $y = \log_{10}(x-2)$.



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

3 **Answer:** sketch complete

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

Show that the roots of the equation $(k-2)x^2 - (3k-2)x + 2k = 0$ are real.

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

4 **Answer:** result shown

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

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

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Result Number 19

Old Higher Maths (1989-2015) 1990 Paper 1, Question 19, Source: ©Higher Still Additional Question Bank. (#2110).

$$\text{If } f(x) = \cos^2 x - \frac{2}{3x^2}, \text{ find } f'(x).$$

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

Answer: $-2\cos x \sin x + 4(4/3)x^{-3}$ or equivalent

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

Topics in this question:

- Higher Differentiate or evaluate derivative: polynomial
- Higher Differentiate or evaluate derivative: composite function
- Higher Integrate or evaluate definite integral: trigonometric expression

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

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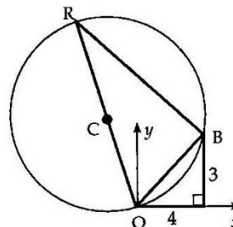
Result Number 20

Old Higher Maths (1989-2015) 1990 Paper 1, Question 20, Source: ©Higher Still Additional Question Bank. (#2111).

The right-angled triangle OAB with sides of length 3cm, 4cm and 5cm is placed with one vertex at the origin as shown in the diagram.

A circle centre C and diameter RO of length 13cm is drawn and passes through O and B.

What is the gradient of the line RO?



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

Answer: -3.9

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

Topics in this question:

- Higher Miscellaneous - not covered by any other subcategory
- Higher Angles and straight lines: $m = \tan \theta$

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

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Result Number 1

Old Higher Maths
(1989-2015) 1990
Paper 2, Question 01,
Source: ©Higher Still
Additional Question
Bank. (#2112).

A function f is defined by the formula $f(x) = (x-1)^2(x+2)$ where $x \in \mathbf{R}$.

- (a) Find the coordinates of the points where the curve with equation $y = f(x)$ crosses the x - and y -axes.
- (b) Find the stationary points of this curve $y = f(x)$ and determine their nature.
- (c) Sketch the curve $y = f(x)$.

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

Answer: (a) (1, 0) (-2, 0) (0, 2) (b) maximum at (-1, 4), minimum at (1, 0) (c) sketch

(7) complete

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

Topics in this question:

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

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) 1990
Paper 2, Question 02,
Source: ©Higher Still
Additional Question
Bank. (#2113).

P, Q and R have coordinates (1, -2), (6, 3) and (9, 14) respectively and are three vertices of a kite PQRS.

- (a) Find the equations of the diagonals of this kite and the coordinates of the point where they intersect.
- (b) Find the coordinates of the fourth vertex S.

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

Answer: (a) $y = 2x - 4$, $x + 2y - 12 = 0$, (4, 4) (b) (2, 5)

(7) [View full mark](#)

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

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 3

Old Higher Maths
(1989-2015) 1990
Paper 2, Question 03,
Source: ©Higher Still
Additional Question

Answer: (a) 73 or 74
(b) 33 or 34

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

Bank. (#2114).

The extract below is taken from the "OIL RIG NEWS".

Topics in this question:

- 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**.

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RARE ILLNESS STRIKES RIG
Storm prevents delivery of medicine

By noon on Tuesday 20th December 1988 50 of our oil rig personnel were laid low by a mystery illness.

Our resident medical officer is expressing concern because the number of personnel affected is increasing each day by 8% of the previous day's total.

- (a) If the daily rate of increase remained at 8% of the previous day's total, how many personnel were affected by noon on Sunday 25th December 1988? (3)
- (b) An improvement in the weather conditions allowed a team of medics to fly out to the rig on the morning of Tuesday 27th December 1988. At noon on that Tuesday, all personnel were innoculated and no new cases of the illness arose. Within the next 24 hours, 21% of those who had been affected had recovered. If the daily rate of recovery of 21% of the previous day's total was maintained, how many personnel were still affected by the illness at noon on Saturday 31st December 1988? (5)

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

Result Number 4

Old Higher Maths (1989-2015) 1990 Paper 2, Question 04, Source: ©Higher Still Additional Question Bank. (#2115).

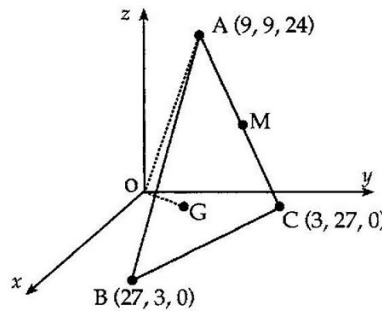
Topics in this question:

- Higher Basic 3d coordinates (now in N5 maths)
- Higher Calculating an angle using the scalar product

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

Remove this Question from Search Results

- (a) Relative to mutually perpendicular axes Ox , Oy and Oz , the vertices of triangle ABC have coordinates $A(9, 9, 24)$, $B(27, 3, 0)$ and $C(3, 27, 0)$. M is the mid-point of AC . Find the coordinates of G which divides BM in the ratio 2:1.
- (b) Calculate the size of angle GOA .



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

- (a) Show that $2\cos(x+30)^\circ - \sin x^\circ$ can be written as $\sqrt{3}\cos x^\circ - 2\sin x^\circ$.
- (b) Express $\sqrt{3}\cos x^\circ - 2\sin x^\circ$ in the form $k\cos(x+\alpha)^\circ$ where $k > 0$ and $0 \leq \alpha < 360$ and find the values of k and α .
- (c) Hence, or otherwise, solve the equation $2\cos(x+30)^\circ = \sin x^\circ + 1$, $0 \leq x < 360$.

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

Result Number 5

Old Higher Maths (1989-2015) 1990 Paper 2, Question 05, Source: ©Higher Still Additional Question Bank. (#2116).

Topics in this question:

- Higher Wave function ($y = a\sin x \pm b\cos x$)
- Higher Apply compound angle formula to simplify or evaluate
- Higher Basic trig equation (no formulae required) in radians or degrees

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

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- (3) **Answer:** (a) result shown (b) $k = \sqrt{7}$, $\alpha = 49.1$ (c) $x = 18.7^\circ$, $x = 243.1^\circ$
- (3) [View full mark scheme \(opens in new frame\).](#)

Result Number 6

Old Higher Maths (1989-2015) 1990 Paper 2, Question 06, Source: ©Higher Still Additional Question

- Answer:** (a) result shown (b) $(x-2)(x+1)(x-4)$ (c) $x = 2$, $x = -1$, $x = 4$

[View full mark](#)

Bank. (#2117).

Topics in this question:

- Higher Composite functions
- Higher Cubic expressions/equations: factorise or solve
- Higher Domain and range

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

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Result Number 7

Old Higher Maths (1989-2015) 1990 Paper 2, Question 07, Source: ©Higher Still Additional Question Bank. (#2118).

Topics in this question:

- 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

Result Number 8

Old Higher Maths (1989-2015) 1990 Paper 2, Question 08, Source: ©Higher Still Additional Question Bank. (#2119).

Topics in this question:

- Higher Circle equation from radius/centre or vice versa
- Higher Intersections of lines and circles (including showing tangency)

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

Remove this Question from Search Results

Result Number 9

Old Higher Maths (1989-2015) 1990 Paper 2, Question 09, Source: ©Higher Still Additional Question Bank. (#2120).

Topics in this question:

- Higher (Old Higher) Questions where pupils explore an intentionally unfamiliar topic

(a) The function f is defined by $f(x) = x^3 - 2x^2 - 5x + 6$.

The function g is defined by $g(x) = x - 1$.

Show that $f(g(x)) = x^3 - 5x^2 + 2x + 8$.

(b) Factorise fully $f(g(x))$.

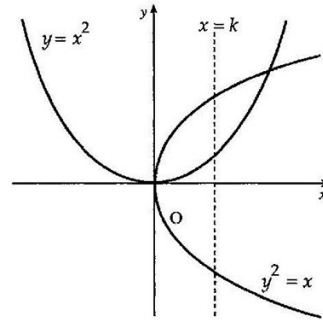
(c) The function k is such that $k(x) = \frac{1}{f(g(x))}$.

For what values of x is the function k not defined?

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

The diagram shows two curves with equations $y = x^2$ and $y^2 = x$.

The area completely enclosed between the two curves is divided in half by the line with equation $x = k$.



(a) Represent these two equal areas by two separate integrals each involving k .

(b) Equate the integrals and show that k is given by the equation

$$2k^3 - 4k^{\frac{3}{2}} + 1 = 0.$$

(c) Use the substitution p^2 for $k^{\frac{3}{2}}$ to find the value of k .

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

A sports club awards trophies in the form of paperweights bearing the club crest. Diagram 1 shows the front view of one of these paperweights. Each is made from two different types of glass. The two circles are concentric and the base line is a tangent to the inner circle.

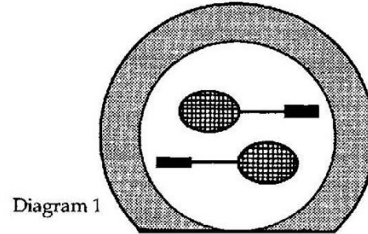


Diagram 1

(a) Relative to x, y coordinate axes, the equation of the outer circle is $x^2 + y^2 - 8x + 2y - 19 = 0$ and the equation of the base line is $y = -6$.

Show that the equation of the inner circle is $x^2 + y^2 - 8x + 2y - 8 = 0$.

(b) An alternative form of the paperweight is made by cutting off a piece of glass from the original design along a second line with equation $3x - 4y + 9 = 0$ as shown in diagram 2.

Show that this line is a tangent to the inner circle and state the coordinates of the point of contact.

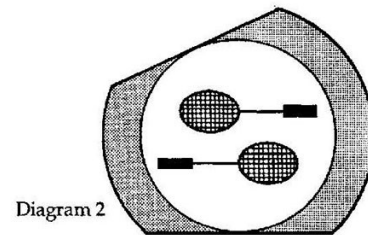


Diagram 2

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

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

(4)

(3)

(2)

Answer: (c) 0.441

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

(6)

(4)

(4)

Answer: (a) result shown (b) (1, 3)

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(4)

(7)

Answer: (b) 0.8

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

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Polynomial equations often have roots which are not whole numbers.

One method of estimating the roots of such equations is to make repeated use of the following:

If $x = p$ is an estimate of a root of the equation $f(x) = 0$, then $x = q$ will be a closer estimate where $q = p - \frac{f(p)}{f'(p)}$.

Example

One of the roots of the equation $x^2 - 2x - 5 = 0$ is known to lie between 3 and 4.

We have $f(x) = x^2 - 2x - 5$ and so $f'(x) = 2x - 2$.

Choose $p = 3$ (1st estimate) then $q = 3 - \frac{f(3)}{f'(3)} = 3 - \frac{-2}{4} = 3.5$.

Choose $p = 3.5$ (2nd estimate) then $q = 3.5 - \frac{f(3.5)}{f'(3.5)} = 3.5 - \frac{0.25}{5} = 3.45$.

Choose $p = 3.45$ (3rd estimate) then $q = 3.45 - \frac{f(3.45)}{f'(3.45)} = 3.45 - \frac{0.0025}{4.9} = 3.449$.

Conclusion The root, correct to 1 decimal place, is $x = 3.4$

- (a) Show that the equation $x^3 - 2x^2 + 6x - 4 = 0$ has a root between 0 and 1. (3)
(b) Use the method described above to find this root correct to 1 decimal place. (6)

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The Water Board of a local authority discovered it was able to represent the approximate amount of water $W(t)$, in millions of gallons, stored in a reservoir

t months after the 1st May 1988 by the formula $W(t) = 1.1 - \sin \frac{\pi t}{6}$.

The board then predicted that under normal conditions this formula would apply for three years.

- (a) Draw and label sketches of the graphs of $y = \sin \frac{\pi t}{6}$ and $y = -\sin \frac{\pi t}{6}$, for $0 \leq t \leq 36$ on the same diagram. (4)
- (b) On a separate diagram and using the same scale on the t -axis as you used in part (a), draw a sketch of the graph of $W(t) = 1.1 - \sin \frac{\pi t}{6}$. (3)
- (c) On the 1st April 1990 a serious fire required an extra $\frac{1}{4}$ million gallons of water from the reservoir to bring the fire under control. Assuming that the previous trend continues from the new lower level, when will the reservoir run dry if water rationing is not imposed? (3)

Answer: (a) sketch drawn (b) sketch drawn (c) July 1990

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Result Number 10

Old Higher Maths (1989-2015) 1990 Paper 2, Question 10, Source: ©Higher Still Additional Question Bank. (#2121).

Topics in this question:

- Higher Miscellaneous - not covered by any other subcategory

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

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