ADA PINPOINT PACKS

81_to_100_Percent_Pinpoint_AI_Pack

Made for Grade8to9
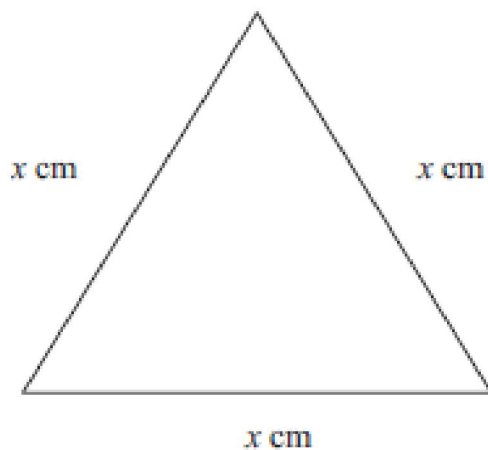
AO1,2_and_3

ALL_Strands

Calc_Only

Created by A.D.A:

Pinpoints Automatic Differention Algorithmn

Designed and Programmed by

Tom Quilter, Anne Mcateer + Jon Hargreaves
... All maths teachers.

Question 1 (AO3): 18% of students got this right

15. The diagram shows an equilateral triangle.

The area of the equilateral triangle is 36 cm^2.

Find the value of x.
Give your answer correct to 3 significant figures.

Question 2 (AO2): 18% of students got this right
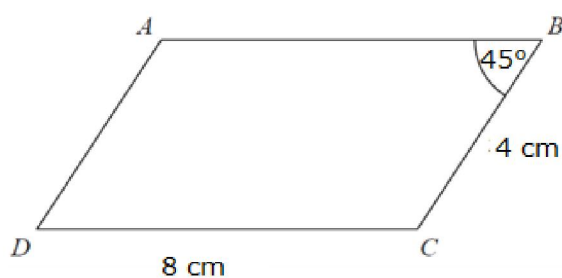
23. Given is a parallelogram.

Diagram **NOT** accurately drawn

$DC = 8$ cm
$CB = 4$ cm
Angle ABC is 45°

Determine the area of the parallelogram.
Round your answer up to 1 decimal place.

.... cm^2

(Total 3 marks)

Question 3 (AO2): 18% of students got this right

6 $100^a \times 1000^b$ can be written in the form 10^w

(*c*) Show that $w = 2a + 3b$

Question 4 (AO3): 17% of students got this right

16. Liquid A has a density of 1.3 g/cm^3.
Liquid B has a density of 1.7 g/cm^3.

Liquid C contains 117 g of liquid A and 170 g of liquid B.

Determine the density of liquid C.

.... g/cm^3

(Total 4 marks)

_____

Question 5 (AO2): 16% of students got this right

21   (*a*) Show that the equation $3x^2 - x^3 + 3 = 0$ can be rearranged to give

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

(*b*) Using

$$x_{n+1} = 3 + \frac{3}{x_n^2} \qquad \text{with } x_0 = 3.2,$$

find the values of x_1, x_2 and x_3

(*c*) Explain what the values of x_1, x_2 and x_3 represent.

Question 6 (AO1): 16% of students got this right

13. The function f is defined as

$$f(x) = \frac{x-6}{2}$$

The function g is defined as

$$g(x) = \sqrt{x-4}$$

(c) Express the function gf in the form gf(x) = …
     Give your answer as simply as possible.

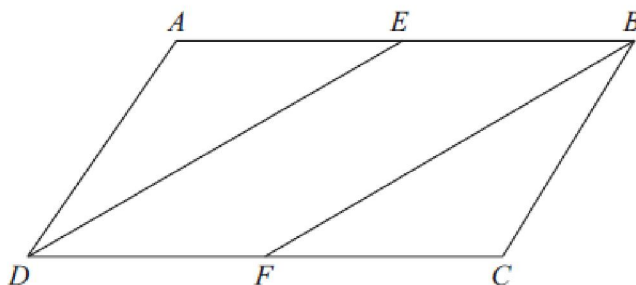gf(x) = ...

(2)

(Total 5 marks)

_____

Question 7 (AO1): 16% of students got this right

19.

ABCD is a parallelogram.
E is the midpoint of *AB*.
F is the midpoint of *DC*.

(a)   Prove that triangle *AED* is congruent to triangle *CFB*.

(3)

Question 8 (AO1): 15% of students got this right

13c   The equation $x^3 - 7x + 5 = 0$ can be arranged to give $x = \dfrac{5}{7 - x^2}$

(c) Starting with $x_0 = 2$,   use the iteration formula $x_{n+1} = \dfrac{5}{7 - x_n^2}$ twice,

to find an estimate for the solution of $x^3 - 7x + 5 = 0$

....

(3)

Question 9 (AO1): 14% of students got this right

15. f is a function such that

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

g is a function such that

$$g(x) = \sqrt{x - 1} \quad x \geq 1$$

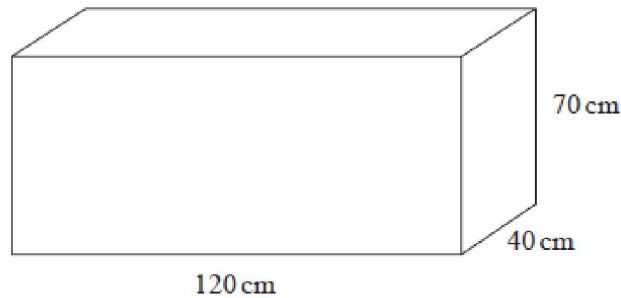(*b*) Find fg(*x*)
Give your answer as simply as possible.

fg(*x*) = ...
(2)

(Total 3 marks)

Question 10 (AO3): 13% of students got this right

17. The diagram shows Helen's fish tank.
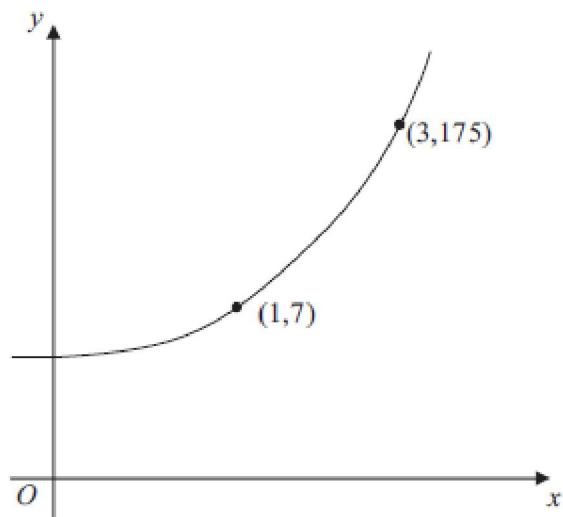   All the dimensions are correct to the nearest centimetre.

Helen is going to use a bucket to fill the fish tank completely with water.
There are 14 litres, correct to the nearest litre, of water in a full bucket.

Will 25 full buckets of water definitely fill the fish tank?
Justify your answer.

(Total for Question 17 is 4 marks)

Question 11 (AO2): 13% of students got this right

18.

The sketch shows a curve with equation

$$y = ka^x$$

where k and a are constants, and $a > 0$

The curve passes through the points (1, 7) and (3, 175).

Calculate the value of k and the value of a.

$k =$ ....

$a =$ ....

(Total 3 marks)
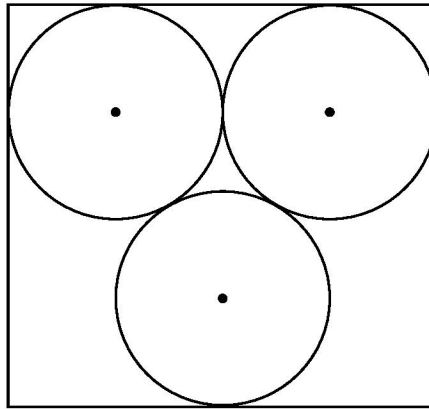
Question 12 (AO3): 12% of students got this right

21 The diagram shows 3 identical circles inside a rectangle.
Each circle touches the other two circles and the sides of the rectangle, as shown in
the diagram.

The radius of each circle is 24 mm.
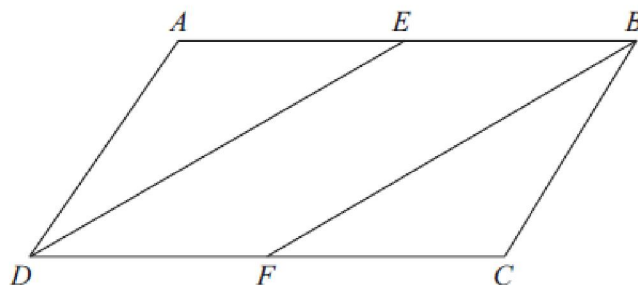
Work out the area of the rectangle.
Give your answer correct to 3 significant figures.

(Total for Question 21 is 4 marks)

_____

Question 13 (AO1): 11% of students got this right

19.

ABCD is a parallelogram.
E is the midpoint of *AB*.
F is the midpoint of *DC*.

(b)   Hence, prove that *DE = FB*

(1)

(Total 4 marks)

Question 14 (AO3): 11% of students got this right

20
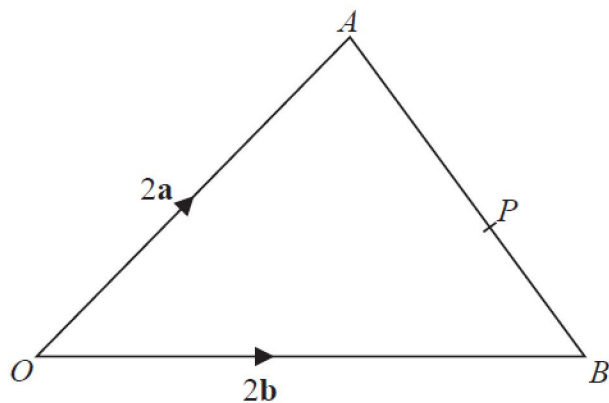
OAB is a triangle.
P is the point on *AB* such that *AP* : *PB* = 5 : 3

$\overrightarrow{OA}$ = 2**a**

$\overrightarrow{OB}$ = 2**b**

$\overrightarrow{OP}$ = *k*(3**a** + 5**b**) where *k* is a scalar quantity.

Find the value of *k*.

Question 15 (AO2): 11% of students got this right

10   Assuming that the population of the UK increases by 0.6% each year,

    (*c*)   Show that the population of the UK each year forms a geometric progression.

Question 16 (AO1): 10% of students got this right

21. $g(x) = \dfrac{4x}{3-x}$ $\qquad\qquad\qquad$ $f(x) = 2x - 5$

Given that $x > 3$, find the exact value of x such that $\quad g^{-1}(x) = f(x)$.

(Total 5 marks)

Question 17 (AO1): 10% of students got this right

18   There are 20 women and 32 men in a sports club.

One woman is going to be chosen for the role of female captain.
A different woman is going to be chosen for the role of female vice-captain.
One man is going to be chosen for the role of male captain.
A different man is going to be chosen for the role of male vice-captain.

Work out how many different ways this can be done.

....

(Total for Question 18 is 3 marks)

_____

Question 18 (AO2): 9% of students got this right

20. Rhys has a beehive.

The number of bees in the beehive is decreasing.

Rhys counts the number of bees in the hive at the start of week 5 He counts the number of bees in the hive at the start of week 7

Here are his results.

week	number of bees
5	1200
7	900

Assuming that the population of bees is decreasing exponentially, how many bees were there at the start of week 2?
You must show your working.

.... bees

(Total 5 marks)

Question 19 (AO1): 8% of students got this right

23   Jess rounds a number, x, to one decimal place.
      The result is 9.8.

(b) Write down the error interval for x.

Question 20 (AO2): 7% of students got this right

28 (*a*) Construct the graph of $x^2 + y^2 = 25$.
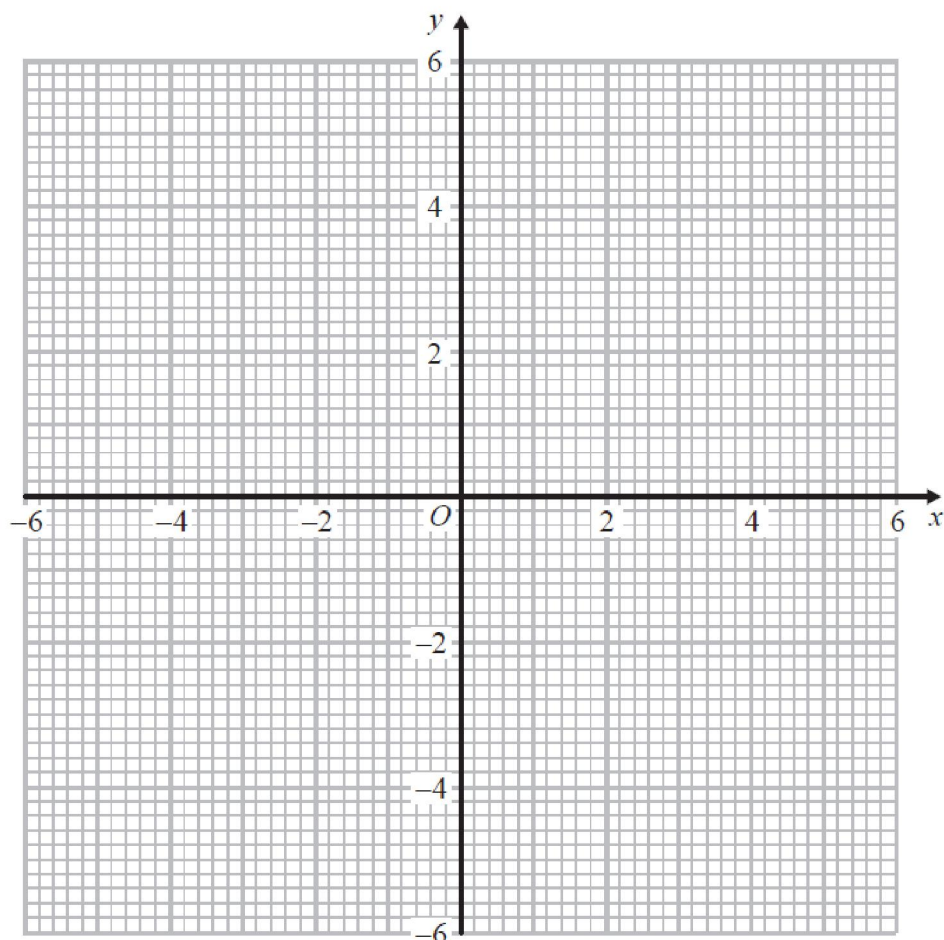
RETEST QUESTION

28 (*b*) Estimate the solutions of the system of equations using the grid.

$$x^2 + y^2 = 25$$
$$y = x - 1$$

....

(3)

(Total 5 marks)

Question 21 (AO3): 7% of students got this right

25. There are some red counters and some white counters in a bag.
At the start, 7 of the counters are red, the rest of the counters are white.

Alfie takes at random a counter from the bag.
He does not put the counter back in the bag.
Alfie then takes at random another counter from the bag.

The probability that the first counter Alfie takes is white **and** the second counter Alfie
takes is red is $\dfrac{21}{80}$.

Work out the number of white counters in the bag at the start.

....

(Total for Question 25 is 5 marks)

Question 22 (AO3): 6% of students got this right

14   The number of fish in a lake decreases by x % each year.

Given that the number of fish halves in 5 years, work out the value of x.
Give your answer correct to 1 decimal place.

....

(Total for Question 14 is 3 marks)

_____

Question 23 (AO2): 5% of students got this right

20
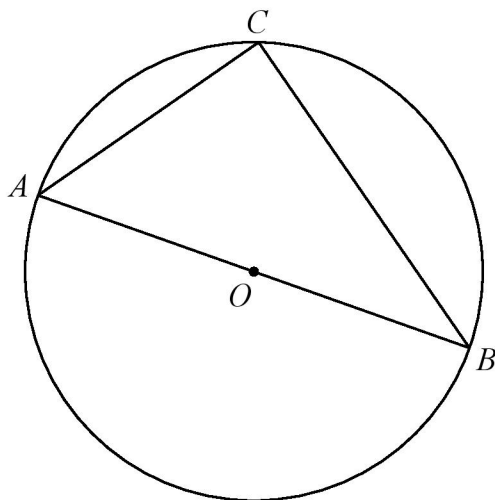
A, B and C are points on the circumference of a circle, centre O.
AOB is a diameter of the circle.

Prove that angle ACB is 90°
You must **not** use any circle theorems in your proof.

Question 24 (AO3): 3% of students got this right

23　S is a geometric sequence.

(*a*)　Given that $(\sqrt{x} - 1)$, 1 and $(\sqrt{x} + 1)$ are the first three terms of S, find the value of x.
You must show all your working.

Answers to Qn 1 (AO3): 18% of students got this right

Question	Working	Answer	Mark	Notes
15	$\dfrac{1}{2} \times x^2 \times \sin 60 = 36$ $x^2 = \dfrac{72}{\sin 60} = 83.13..$	9.12	3	M1 $\dfrac{1}{2} \times x^2 \times \sin 60 (= 36)$ or $\dfrac{1}{2} \times ab \times \sin 60 (= 36)$ Or $\dfrac{1}{2} \times x \times \sqrt{x^2 - \left(\dfrac{x}{2}\right)^2} \ (= 36)$ M1 $x^2 = \dfrac{72}{\sin 60}$ or $ab = \dfrac{72}{\sin 60}$ or $x^2 = \dfrac{36 \times 2}{\sqrt{0.75}}$ A1 $9.11 - 9.12$

Answers to Qn 2 (AO2): 18% of students got this right

23 Here is a parallelogram.

7 cm

A   *B*

40°

A

5 cm

Diagram **NOT** accurately drawn

D   7 cm   *C*
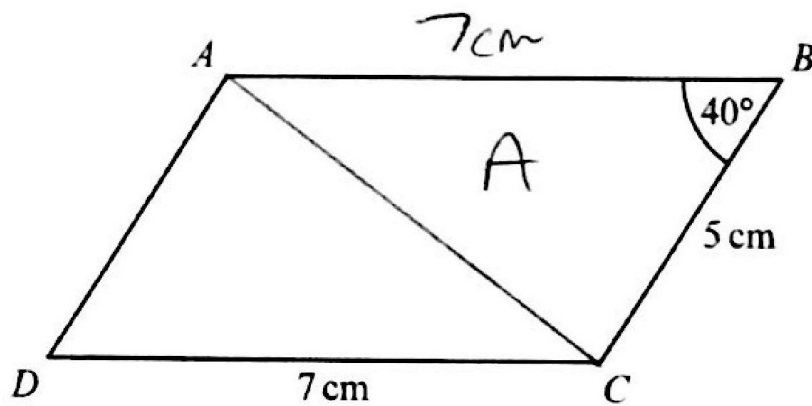
$DC = 7$ cm
$CB = 5$ cm
Angle *ABC* is 40°

Work out the area of the parallelogram.
Give your answer correct to 1 decimal place.

$$\text{area of } A = \tfrac{1}{2} \times 5 \times 7 \times \sin 40$$

$$= 11.24 \ldots$$

$$\text{Total} = 2A = 22.5 \ (3sf)$$

Answers to Qn 3 (AO2): 18% of students got this right

Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
6 (c)		Shown	M1	for writing 100^a or 1000^b as a power of 10 (=10^{2a} or 10^{3b}) or $10^{2a\,+\,3b}$ or 100 = 10² and 1000 = 10³
			C1	for complete chain of reasoning leading to conclusion

Answers to Qn 4 (AO3): 17% of students got this right

16 Liquid A has a density of $0.7 \, g/cm^3$.
Liquid B has a density of $1.6 \, g/cm^3$.

$140 \, g$ of liquid A and $128 \, g$ of liquid B are mixed to make liquid C.

Work out the density of liquid C.

$$\frac{140}{0.7} = 200 \qquad \frac{128}{1.6} = 80$$

Mass of $C = \cancel{280}\ 268$

Density of $C = \frac{268}{280} = 0.957$

Answers to Qn 5 (AO2): 16% of students got this right

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
21(a)		Re arrangement	M1 for re arranging to $x^3 =$ C1 a clear step to show re arrangement
21(b)	$x_1 = 3.29296875$ $x_2 = 3.276659786$ $x_3 = 3.279420685$	3.28	M1 for one correct iteration M1 for 2 further iterations seen A1 cao
21(c)		Statement	C1 Statement eg iteration is an estimation of the solution

Answers to Qn 6 (AO1): 16% of students got this right

Question		Working	Answer	Mark	Notes
13	(c)		$\sqrt{\dfrac{x}{2} - 7}$	2	

Answers to Qn 7 (AO1): 16% of students got this right

Question	Working	Answer	Mark	Notes
19 (a)		congruency proved explains why	3	M1 for correct statement with correct reason M1 for a second correct statement with correct reason C1 for complete proof justifying congruency, eg SAS or AAS Eg DAE = BCF (opposite angles of parallelogram are equal) AE = FC (E and F are midpoints of lines of equal length) AD = BC (opposite sides of parallelogram are equal) AED ≡ CFB (SAS)

Answers to Qn 8 (AO1): 15% of students got this right

13

(c) Starting with $x_0 = 2$, use the iteration formula $x_{n+1} = \dfrac{5}{7 - x_n^2}$ twice,

to find an estimate for the solution of $x^3 - 7x + 5 = 0$

$x_0 = 2 \quad x_1 = \dfrac{5}{7 - (2)^2} = \dfrac{5}{3}$

$x_1 = \dfrac{5}{3} \quad x_2 = \dfrac{5}{7 - \left(\dfrac{5}{3}\right)^2} = \dfrac{45}{38}$

....

(3)

_____

Answers to Qn 9 (AO1): 14% of students got this right

Question		Working	Answer	Mark	Notes
15.	(b)		$\dfrac{1}{x}$	2	M1 $\dfrac{1}{(\sqrt{x-1})^2+1}$ or $\dfrac{1}{x-1+1}$ A1 (Also accept x^{-1})

Answers to Qn 10 (AO3): 13% of students got this right

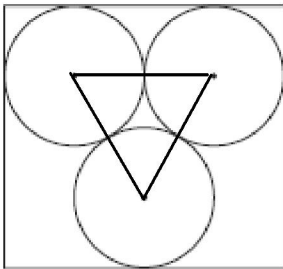| 17		No with justification	P1	for one correct bound, e.g. 69.5, 70.5, 39.5, 40.5, 121.5, 122.5, 13.5, 14.5
			P1	for complete process to find the upper bound for the volume of the tank, e.g. $120.5 \times 40.5 \times 70.5$ (= 344057.625)
			P1	for complete process to find the upper bound for the number of buckets, (upper bound for volume of tank ÷ lower bound for volume of bucket) e.g. "344057.625" ÷ 13500. Must be in consistent units **OR** correct process to compare the lower bound for 25 buckets of water with the upper bound for the volume of the tank, e.g. $13.5 \times 1000 \times 25$ (=337500)
			C1	Correct conclusion based on correct calculations

Answers to Qn 11 (AO2): 13% of students got this right

| 18. | | $7 = ka^1$; $175 = ka^3$

 $k = \dfrac{7}{a}$, $175 = \dfrac{7a^3}{a}$,
 $175 = 7a^2$

 $a^2 = 25$, so $a = 5$, $k = 1.4$

 Or

 $7^3 = k^3 a^3$, $175 = ka^3$

 $k^2 = \dfrac{7^3}{175}$, $k = 1.4$, $a = 5$ | $k = 1.4$
 $a = 5$ | 3 | M1 either $a^2 = 25$

 or $7 = ka$ (or $7 = ka^1$) and $175 = ka^3$

 A1 $k = 1.4$ (or equivalent)

 A1 $a = 5$

 SC Either $a = 5$ or $k = 1.4$ (or equivalent) gets B2 |

Answers to Qn 12 (AO3): 12% of students got this right

Question 21 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$24 \times 4 = 96$	P1	This mark is given for a process to find the length of the rectangle
	$48 \sin 60° = 48 \times \dfrac{\sqrt{3}}{2} = 24\sqrt{3}$ or $\sqrt{(48^2 - 24^2)} = 24\sqrt{3}$	P1	This mark is given for a process to find the perpendicular height of an equilateral triangle of side 48 cm
	$24 + 24 + 24\sqrt{3} = 89.569\ldots$	P1	This mark is given for a complete process to find the width of rectangle
	8600 (to 3 significant figures)	A1	This mark is given for a correct answer only

Answers to Qn 13 (AO1): 11% of students got this right

Question		Working	Answer	Mark	Notes
19	(b)		DE = FB	1	C1 for relevant statement using congruency Eg DE and FB are corresponding sides of congruent triangles

Answers to Qn 14 (AO3): 11% of students got this right

Paper 1MA1: 3H			
Question	Working	Answer	Notes
20		$\dfrac{1}{4}$	P1 starts process eg $\overrightarrow{AB} = 2\mathbf{b} - 2\mathbf{a}$ P1 process to find $\overrightarrow{AP}$ or $\overrightarrow{BP}$ P1 complete process to find $\overrightarrow{OP}$ A1 for $\dfrac{1}{4}$ oe

Answers to Qn 15 (AO2): 11% of students got this right

Question		Working	Answer	Mark	Notes
10	(c)		Correct argument	M1	for method to find the common ratio, e.g. finds population in 3 successive yrs or 1.006
				C1	for convincing conclusion, e.g. terms are generated by multiplying previous term by 1.006 so a geometric progression is formed

Answers to Qn 16 (AO1): 10% of students got this right

21.				5	M1 method to find $g^{-1}(x)$
					A1 $g^{-1}(x) = \dfrac{3x}{4+x}$
					M1 $3x = (2x+5)(4+x)$
					M1 correct expansion of brackets
			$\sqrt{10}$		A1

Answers to Qn 17 (AO1): 10% of students got this right

18   There are 20 women and 32 men in a sports club.

One woman is going to be chosen for the role of female captain.
A different woman is going to be chosen for the role of female vice-captain.
One man is going to be chosen for the role of male captain.
A different man is going to be chosen for the role of male vice-captain.

Work out how many different ways this can be done.

$$20 \times 19 \times 32 \times 31 = 376\,960 \text{ different ways}$$

....

(Total for Question 18 is 3 marks)
_____

Answers to Qn 18 (AO2): 9% of students got this right

20.			1847 – 1848	5	M1 for correct method to establish week 6 population as $1200 \times x$ oe

M1 for forming equation $1200\,x^2 = 900$

M1 for method to solve equation to establish $x = \dfrac{\sqrt{3}}{2}$

M1 for correct method for week 2 population

e.g. $1200 \div \left(\dfrac{\sqrt{3}}{2}\right)^3$ oe

A1 for 1847 – 1848 given as answer dependent on working seen

OR

M1 for establishing population is of form $N = Ab^t$ oe

M1 for substituting $t = 5$, $N = 1200$ gives $1200 = Ax^5$

M1 for substituting $t = 7$, $N = 900$ gives $900 = Ax^7$

or $900 = 1200x^2$ and $x^2 = \dfrac{3}{4}$ so $x = \dfrac{\sqrt{3}}{2}$

M1 for correct method for week 2 population

e.g. $1200 \div \left(\dfrac{\sqrt{3}}{2}\right)^3$ oe

A1 for 1847 – 1848 given as answer dependent on working seen

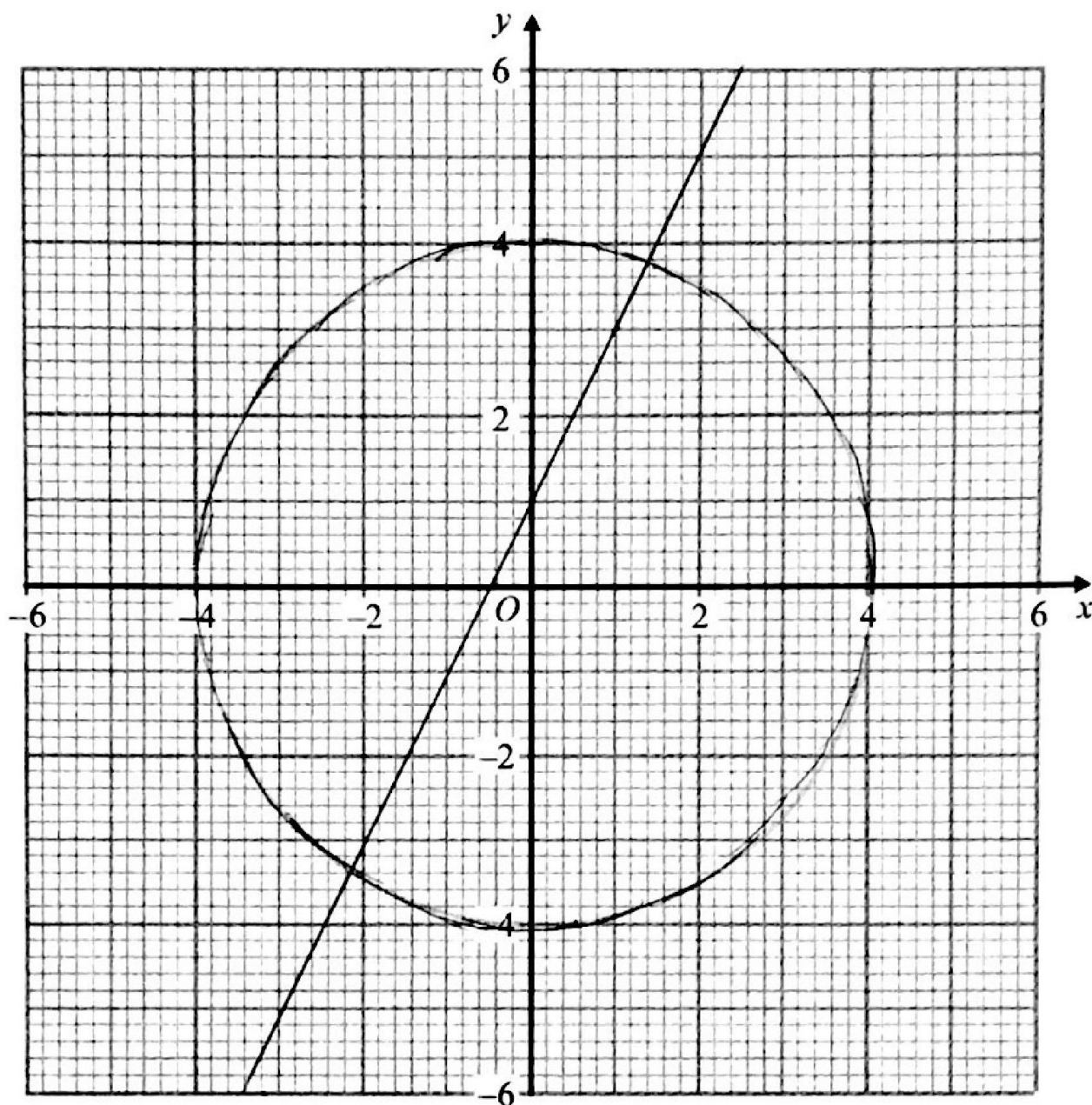# Answers to Qn 19 (AO1): 8% of students got this right

Part	Working an or answer examiner might expect to see	Mark	Notes
23 (b)		1	This mark is given for 9.75 and 9.85 seen
	$9.75 \leq x < 9.85$	1	This mark is given for the correct answer only

Answers to Qn 20 (AO2): 7% of students got this right

28 (a) On the grid, construct the graph of $x^2 + y^2 = 16$

(b) Find estimates for the solutions of the simultaneous equations

$$x^2 + y^2 = 16$$
$$y = 2x + 1$$

Answers to Qn 21 (AO3): 7% of students got this right

25		9	P1	for process to start to solve problem, e.g. $\frac{x}{x+7}$ or $\frac{7}{x+6}$
			P1	for a correct product, e.g. $\frac{x}{x+7} \times \frac{7}{x+6} = \left(\frac{21}{80}\right)$
			P1	for processes to arrive at correct quadratic, e.g. $21x^2 - 287x + 882 = 0$
			P1	(dep on P2) correct substitution into the quadratic formula or factorisation of their quadratic.
			A1	cao

Answers to Qn 22 (AO3): 6% of students got this right

14 The number of fish in a lake decreases by x % each year.

Given that the number of fish halves in 5 years, work out the value of x.
Give your answer correct to 1 decimal place.

$$0.5 = \left(1 - \frac{x}{100}\right)^5$$

$$\left(1 - \frac{x}{100}\right) = \sqrt[5]{0.5} = 0.87(...)$$

$$0.129(...) = \frac{x}{100}$$

$$x = 12.9\%$$

Answers to Qn 23 (AO2): 5% of students got this right

Part	Working or answer an examiner might expect to see	Mark	Notes
20	base angles of an isosceles triangle are equal	1	This mark is given for drawing the line *OC* to make an isosceles triangles *OBC* and *AOC*
	$x + x + y + y = 180°$ angles in a triangle add up to 180	1	This mark is given for finding the sum of the angles in triangle *ABC*
	$2x + 2y = 2(x + y) = 180,$ so $x + y =$ angle $ACB = 90°$	1	This mark is given for a complete proof to show ACB = 90°
		1	This mark is given for a complete proof with all reasons given

Answers to Qn 24 (AO3): 3% of students got this right

Paper: 1MA1/2H

Question	Working	Answer	Mark	Notes
23 (a)		2	M1	for start to express the common ratio algebraically, eg $1/(\sqrt{x} - 1)$ or $(\sqrt{x} + 1)/1$ or $\sqrt{x} + 1 = k \times 1$ or $1 = k \times(\sqrt{x} - 1)$
			M1	for setting up an appropriate equation in x, eg $1/(\sqrt{x} - 1) = (\sqrt{x} + 1)/1$
			C1	for convincing argument to show $x = 2$