Write your name here

| Surname | Other names |
|---|---|
| | |

**Pearson Edexcel**
**Level 1/Level 2 GCSE (9 - 1)**

Centre Number | | | | | |

Candidate Number | | | | |

# Mathematics

## Paper 1 (Non-Calculator)

Solutions

**Higher Tier**

Mock Set 3 – Autumn 2017
**Time: 1 hour 30 minutes**

Paper Reference
**1MA1/1H**

**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser. Tracing paper may be used.

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may not be used.**

## Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

S57492A



6/7/2/1/4/

S 5 7 4 9 2 A 0 1 2 4

Pearson

**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

**1** (a) Write $\frac{3^5 \times 3^4}{3^2}$ as a power of 3

$\frac{3^5 \times 3^4}{3^2} = \frac{3^9}{3^2} = 3^7$

$3^7$

**(2)**

(b) Write down the value of $12^0$

$12^0 = 1$

$1$

**(1)**

(c) Write down the value of $3^{-2}$

$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$

$\frac{1}{9}$

**(1)**

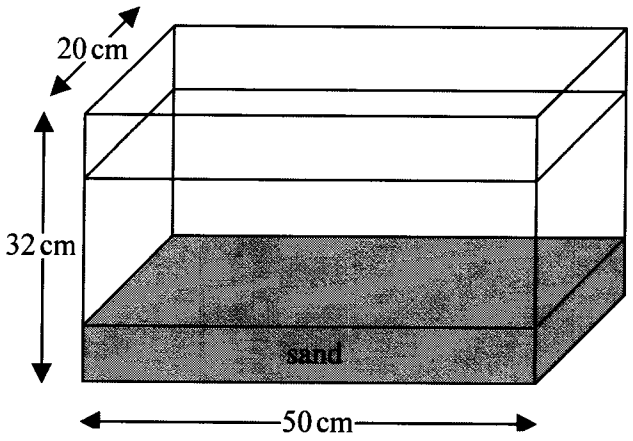
**(Total for Question 1 is 4 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**2** The diagram shows a fish tank in the shape of a cuboid.




The dimensions of the tank are 50 cm by 32 cm by 20 cm.

The tank is $\frac{3}{4}$ full of water and sand.

The ratio of the volume of water to the volume of sand is 5 : 1

Work out the number of litres of water in the tank.
You must show all your working.

Volume of tank $= 50 \times 32 \times 20 \text{ cm}^3$

$= 1000 \times 32$

$= 32000 \text{ cm}^3$

$= 32$ litres capacity

$\frac{3}{4}$ full so $32 \times \frac{3}{4} = 24$ litres of water and sand

Water : Sand

$= 5 : 1 \quad = 6$ parts

1 part $= \frac{24}{6} = 4$ litres

Water 5 parts so $5 \times 4 = 20$ litres

20 litres

**(Total for Question 2 is 5 marks)**

3 In a sale, the price of a cooker is reduced by 50%
At the end of the sale, the sale price of the cooker is increased by 50%

Betty says,

"The cooker is now the same price as it was before the sale."

Is Betty correct?
Explain why.

No the two percentages are not based on the same starting amount

Final = Start $\times \frac{1}{2} \times \frac{3}{2}$ = $\frac{3}{4}$ of start price

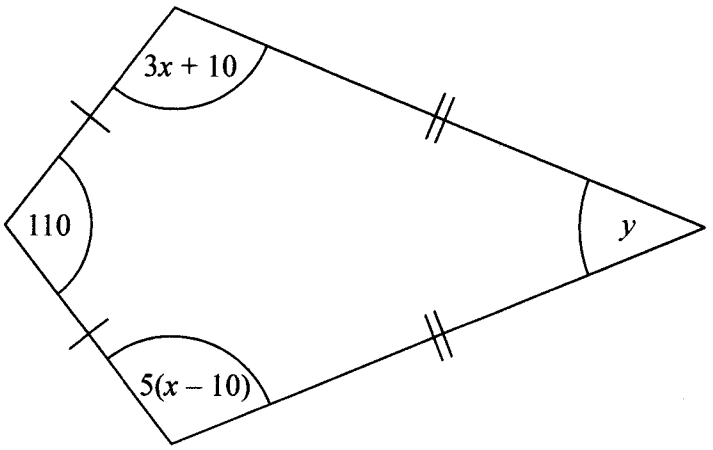
**(Total for Question 3 is 2 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**4** Here is a kite.




All angles are measured in degrees.

Work out the value of $y$.

Kite so $3x+10 = 5(x-10)$

$3x+10 = 5x-50$

$10+50 = 5x-3x$

$60 = 2x$

$\frac{60}{2} = x$

$30 = x$

So $3x+10 = 5(x-10) = 100$

Angles of kite add up to 360°

$y = 360 - (110+100+100)$

$y = 360 - 310$

$y = 50$

$y = 50$

**(Total for Question 4 is 4 marks)**

**5** Solve the simultaneous equations

$3x - 2y = -5$ (1)
$2x - 4y = 2$ (2)

(1) × 2 $\quad 6x - 4y = -10$ (3)

(3) − (2) $\quad 4x = -12$

$x = -\frac{12}{4}$

$x = -3$

Sub for $x$ in (1)

$3(-3) - 2y = -5$

$-9 - 2y = -5$

$-2y = -5 + 9$

$-2y = 4$

$y = \frac{4}{-2}$

$y = -2$

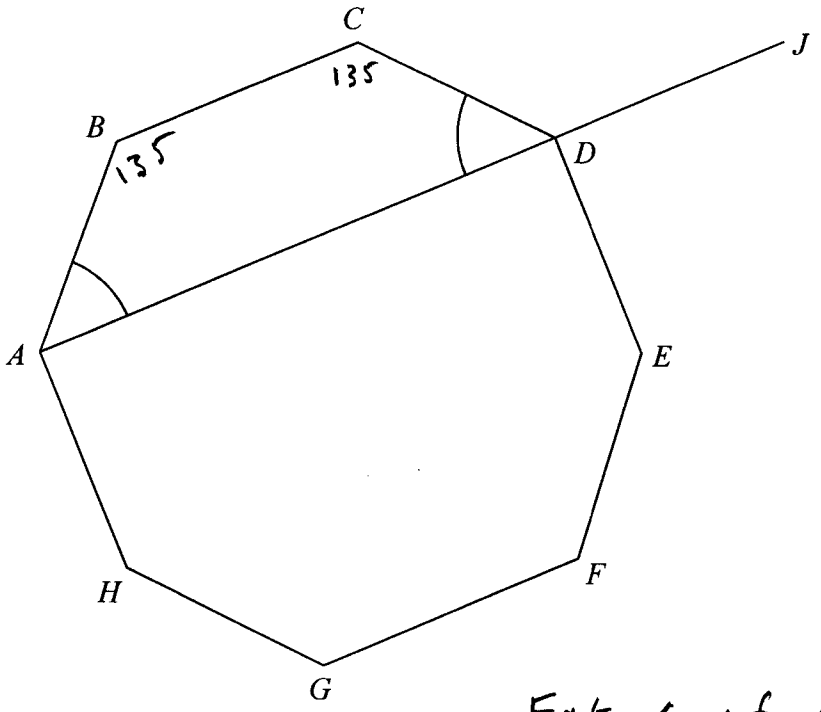
$x =$ $-3$

$y =$ $-2$

**(Total for Question 5 is 3 marks)**

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

6




*ABCDEFGH* is a regular octagon.
*ADJ* is a straight line.

angle *BAD* = angle *CDA*

Show that angle *CDJ* = 135°

Ext ∠ of reg oct
$= \frac{360}{8} = 45°$

Int ∠ $= 180 - 45$
$= 135°$

$\therefore \angle ABC = \angle BCD = 135°$

Angles of quadrilateral ABCD sum to 360°

$\therefore \angle CDA = \frac{360 - 135 - 135}{2} = 45$

$\angle CDJ = 180 - 45 = 135°$ (∠s on str line add up to 180°)

**(Total for Question 6 is 4 marks)**

7 (a) Write 0.00549 in standard form.

$5.49 \times 10^{-3}$

(1)

(b) Find the value of $(8 \times 10^3)^2$
Give your answer in standard form.

$(8 \times 10^3)^2 = (8 \times 10^3) \times (8 \times 10^3)$
$= 64 \times 10^6$
$= 6.4 \times 10^7$

$6.4 \times 10^7$

(2)

(c) Find the value of $(7.6 \times 10^5) + (8.7 \times 10^4)$
Give your answer in standard form.

760000
87000 +
847000

$= 8.47 \times 10^5$

$8.47 \times 10^5$

(2)

**(Total for Question 7 is 5 marks)**

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

**8** 20 men, 10 women and 10 children are in a competition.

The mean score for the women is 15.6
The mean score for the children is 9.2

Kevin says that the mean score for all 40 people is 11.2

11.2
40 ×
448.0

(a) Work out the mean score for the men.

Total Marks for all = 40 × 11.2 = 448
Total Marks for women = 15.6 × 10 = 156
Total Marks for children = 9.2 × 10 = 92

Total marks for men = 448 − 156 − 92 = 200

3 4 4 8
1 5 6 −
2 9 2
9 2 −
2 0 0

Mean score for men
= $\frac{200}{20}$ = 10

10

(3)

Kevin was wrong.
The mean score for all 40 people was actually 11.15

(b) How does this affect the mean score for the men?

Mean score for men would be lower than 10

(1)

**(Total for Question 8 is 4 marks)**

**9** The stem and leaf diagram shows the ages, in years, of 25 people.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7 | 7 | 8 | 9 | | | | | | | | | |
| 2 | 1 | 2 | 4 | 4 | 5 | 5 | 6 | 7 | 8 | 9 | 9 | | |
| 3 | 0 | 1 | 2 | 2 | 3 | 4 | 5 | 6 | | | | | |
| 4 | 0 | 1 | | | | | | | | | | | |

Key: 1|7 represents 17 years

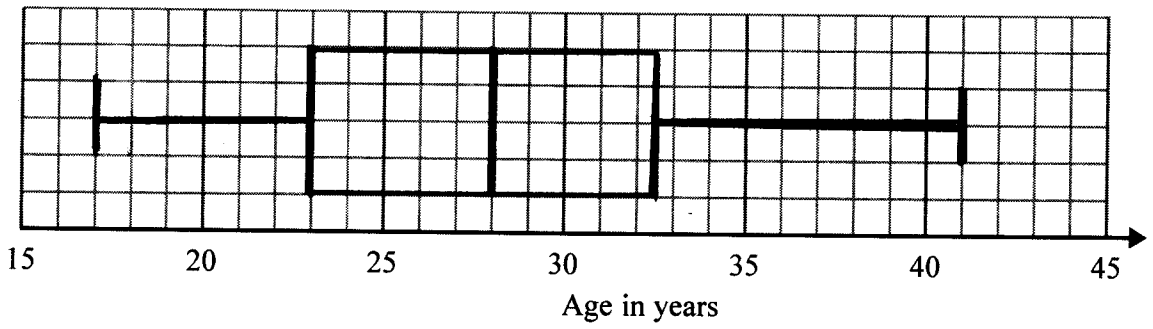
median 13th

$Q_1$ 6.5th

$Q_3$ 19.5th

$Q_1 = 23$ $Q_2 = 28$ $Q_3 = 32.5$

(a) (i) On the grid, draw a box plot for this information.




(3)

One of these people is chosen at random.

(ii) What is the probability that this person is 30 years of age or older?

10 aged 30 or older

so prob = $\frac{10}{25}$

$\frac{10}{25}$

(2)

The grouped frequency table gives information about the ages of a different group of people.

| Age ($a$ years) | Frequency |
|---|---|
| $0 < a \leqslant 20$ | 7 |
| $20 < a \leqslant 30$ | 12 |
| $30 < a \leqslant 40$ | 5 |
| $40 < a \leqslant 50$ | 1 |

Anne drew this cumulative frequency table for this information.

Should be

$0 < a \leq 20$
$0 < a \leq 30$
$0 < a \leq 40$
$0 < a \leq 50$

| Age ($a$ years) | Cumulative frequency |
|---|---|
| $0 < a \leqslant 20$ | 7 |
| $20 < a \leqslant 30$ | 19 |
| $30 < a \leqslant 40$ | 24 |
| $40 < a \leqslant 50$ | 25 |

The cumulative frequency table is **not** correct.

(b) Write down one thing that is wrong with the table.

Cumulative Age Groups should all start at 0 as shown

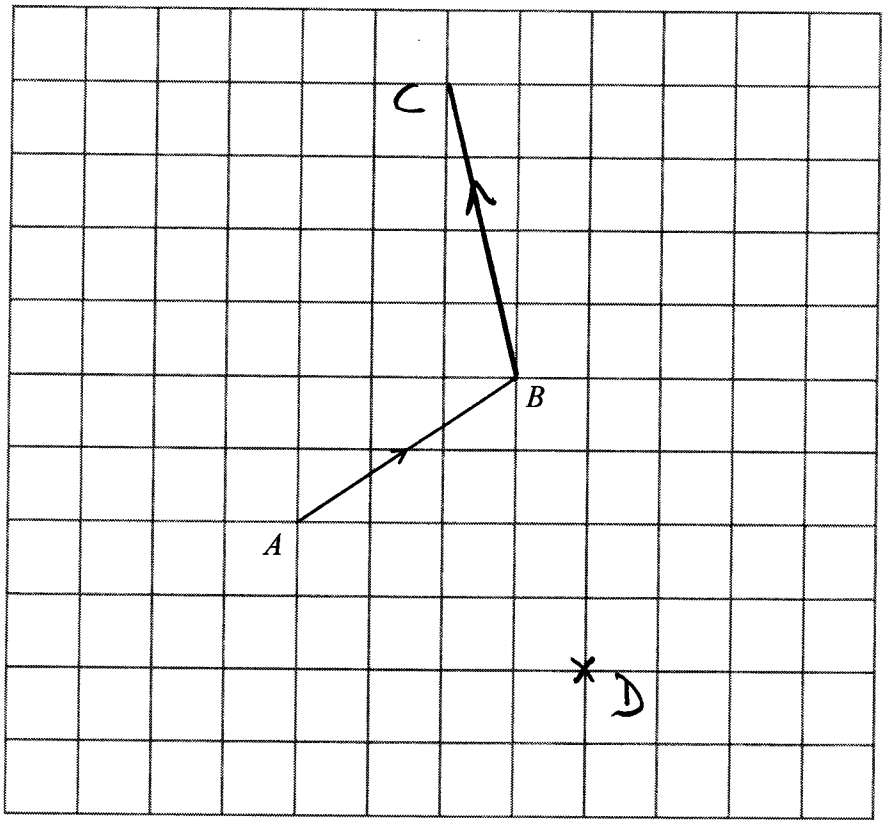
(1)

**(Total for Question 9 is 6 marks)**

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

**10** $\overrightarrow{AB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

$\overrightarrow{AB}$ is shown on the grid.




(a) On the grid, draw $\overrightarrow{BC}$.

**(1)**

$\overrightarrow{AD} = \overrightarrow{AB} - \overrightarrow{BC}$

(b) On the grid, mark with a cross (×) the position of $D$.
Label this point $D$.

**(2)**

**(Total for Question 10 is 3 marks)**

**11** $P$ is inversely proportional to the square root of $m$.

$P = 10$ when $m = \frac{1}{4}$

Work out the value of $m$ when $P = 2$

$$P = \frac{k}{\sqrt{m}}$$

$$10 = \frac{k}{\sqrt{\frac{1}{4}}}$$

$$10 = \frac{k}{\frac{1}{2}}$$

$$10 \times \tfrac{1}{2} = k$$

$$5 = k$$

$$P = \frac{5}{\sqrt{m}}$$

when $P = 2$

$$2 = \frac{5}{\sqrt{m}}$$

$$2\sqrt{m} = 5$$

$$\sqrt{m} = \frac{5}{2}$$

$$m = \left(\frac{5}{2}\right)^2$$

$$m = \frac{25}{4}$$

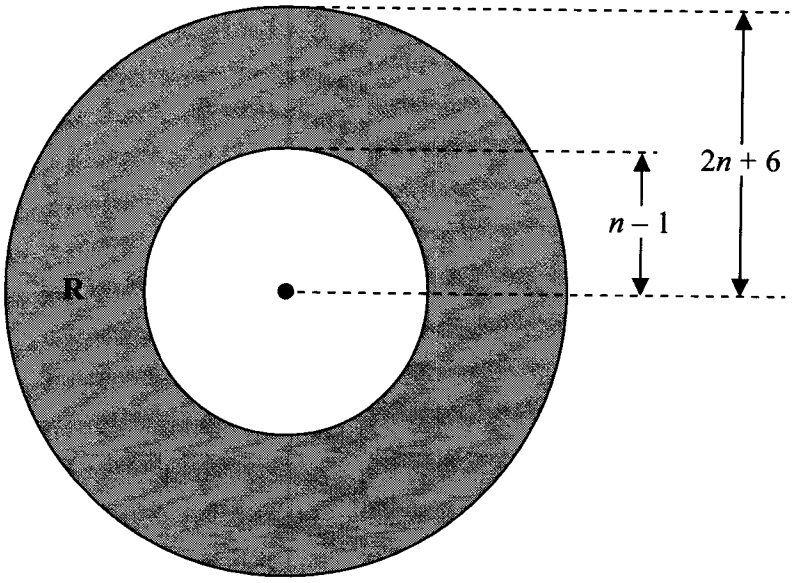
**(Total for Question 11 is 3 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**12** The region **R**, shown shaded in the diagram, is the region between two circles with the same centre.




The outer circle has radius $(2n + 6)$
The inner circle has radius $(n - 1)$
All measurements are in centimetres.

The area of **R** is greater than the area of a circle of radius $(n + 13)$ cm.

$n$ is an integer.

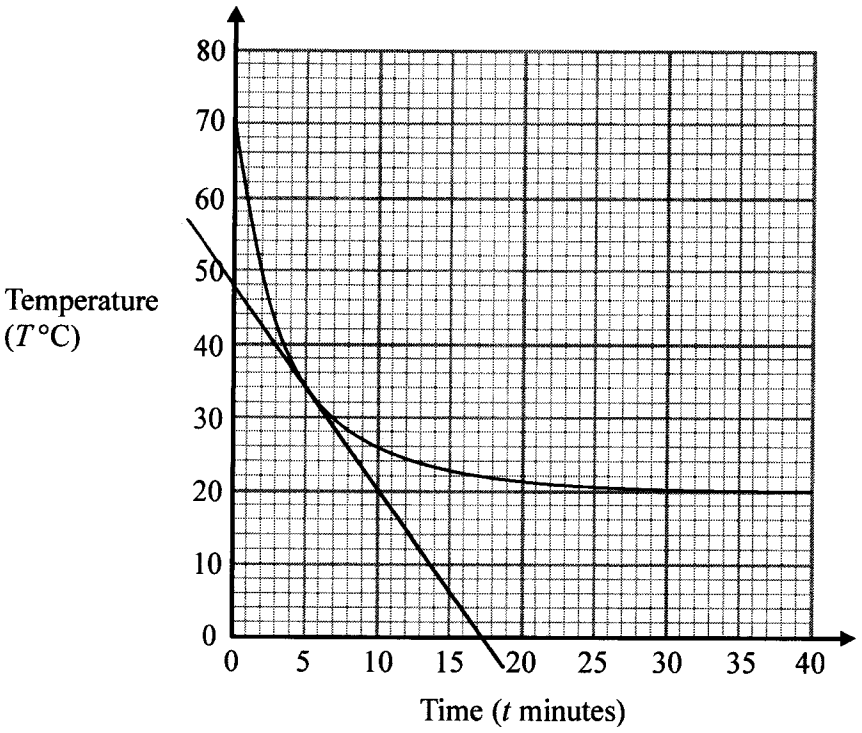
Find the least possible value of $n$.
You must show all of your working.

$$\pi(2n+6)^2 - \pi(n-1)^2 > \pi(n+13)^2$$
$$(2n+6)^2 - (n-1)^2 > (n+13)^2$$
$$4n^2+24n+36-(n^2-2n+1) > n^2+26n+169$$
$$4n^2+24n+36-n^2+2n-1-n^2-26n-169>0$$
$$2n^2-134>0$$
$$n^2-67>0$$
$$n^2>67$$
$$\Rightarrow n>8$$
$$n \geqslant 9$$

least $n = 9$

**(Total for Question 12 is 5 marks)**

**13** The graph shows the temperature, $T$°C, of the coffee in a cup at a time $t$ minutes.




(a) Find an estimate for the gradient of the graph at time 5 minutes.

(0, 48) (10, 20)

$\frac{20-48}{10-0} = \frac{-28}{10} = -2.8$

$-2.8$

**(2)**

(b) Explain what this gradient represents.

Instantaneous rate of change of temperature after 5 min

Cooling at $2.8^{\circ}$ per min at that time

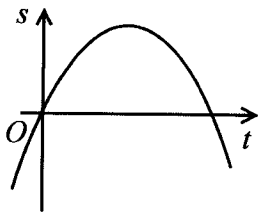
**(1)**

**(Total for Question 13 is 3 marks)**

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

**14** A particle $P$ is moving in a straight line.
$O$ is a fixed point on the straight line.
The distance, $s$ metres, of $P$ from $O$ at time $t$ seconds is given by

$$s = 80t - 5t^2$$




Use algebra to find the greatest distance of $P$ from $O$ when $0 \leqslant t \leqslant 16$

when $s = 0$ $\quad 80t - 5t^2 = 0$

$5t(16 - t) = 0$

$t = 0$ or $t = 16$

Symmetry of quadratic graph $\Rightarrow$ max $s$ at $t = 8$

$\text{max } s = 80 \times 8 - 5(8)^2$

$= 640 - 5 \times 64$

$= 640 - 320$

$= 320$ m

64
× 5
320

320 metres

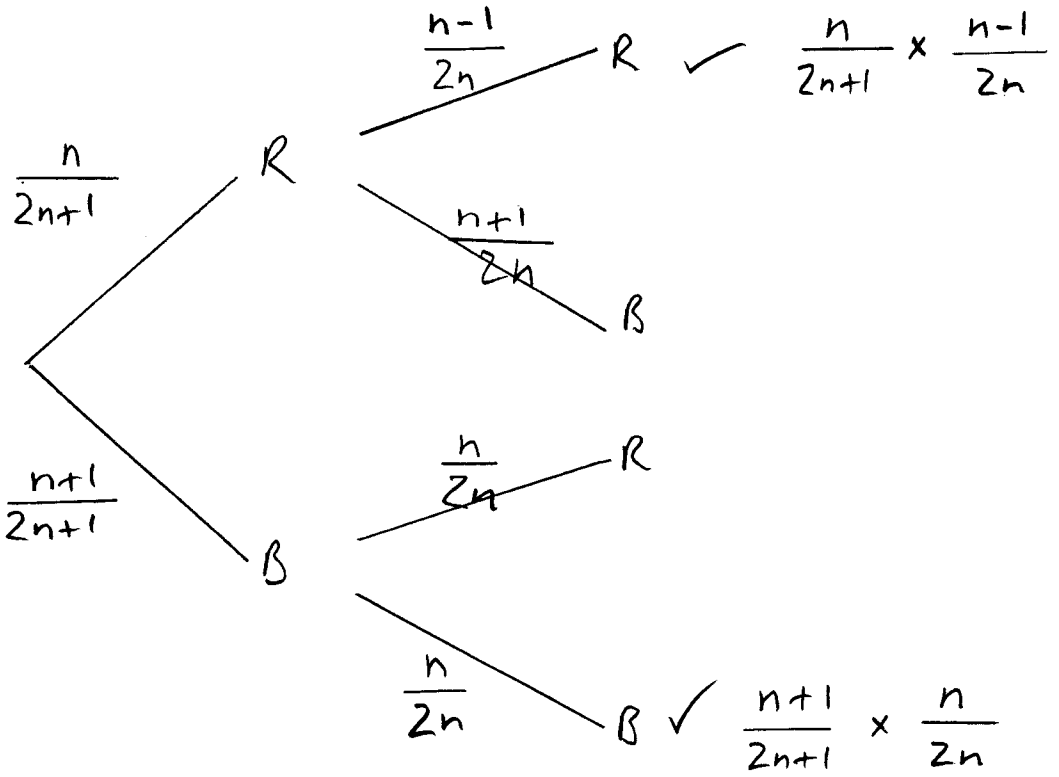
**(Total for Question 14 is 4 marks)**

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

**15** There are only $n$ red balls and $(n + 1)$ blue balls in a bag.

Shamsa takes at random 2 balls from the bag.

Show that the probability that both balls are the same colour is $\frac{n}{2n+1}$




$$P(\text{Same Colour}) = \frac{n(n-1)}{(2n+1)2n} + \frac{(n+1)n}{(2n+1)2n}$$

$$= \frac{n^2-n+n^2+n}{(2n+1)2n} = \frac{2n^2}{(2n+1)2n} = \frac{n}{2n+1}$$

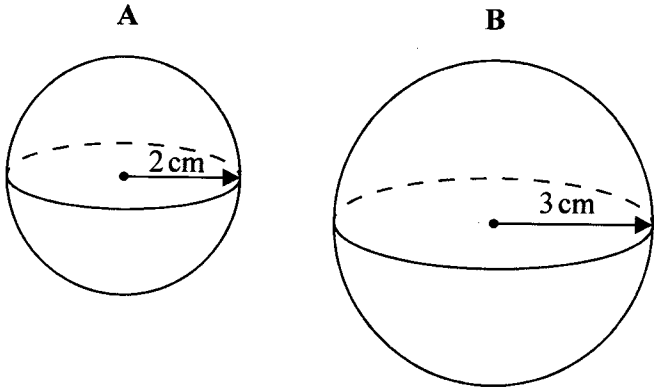
**(Total for Question 15 is 4 marks)**

DO NOT WRITE IN THIS AREA

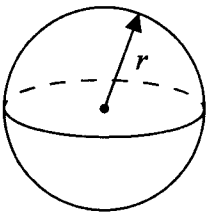
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**16** Here are two solid spheres, **A** and **B**.




Volume of sphere $= \frac{4}{3}\pi r^3$




Sphere **A** is made of gold.
Sphere **B** is made of silver.

Mass = Vol × Density

Sphere **A** has radius 2 cm. = 0.02 m
Sphere **B** has radius 3 cm. = 0.03 m

1.9
× 8
7
15.2

Gold has a density of 19 000 kg/m$^3$
Silver has a density of 10 000 kg/m$^3$

Which sphere has the greater mass?
You must show how you get your answer.

A Mass $= \frac{4}{3}\pi \times 0.02^3 \times 19000$ kg

B Mass $= \frac{4}{3}\pi \times 0.03^3 \times 10000$ kg

A $= \frac{4}{3}\pi \times 0.000008 \times 19000$ kg

B $= \frac{4}{3}\pi \times 0.000027 \times 10000$ kg

A $= \frac{4}{3}\pi \times 8 \times 10^{-6} \times 1.9 \times 10^4 = 15.2 \times 10^{-2} = 0.152$ kg
$\times \frac{4}{3}\pi$ $\times \frac{4}{3}\pi$

B $= \frac{4}{3}\pi \times 2.7 \times 10^{-5} \times 10^4 = 2.7 \times 10^{-1} = 0.27$ kg
$\times \frac{4}{3}\pi$ $\times \frac{4}{3}\pi$

$0.27 > 0.152$

So B made of silver has greatest mass

**(Total for Question 16 is 4 marks)**

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

**17** $x^2 - 9y^2 = 0$ where $x > 0$ and $y > 0$

(a) Work out the ratio $x : y$

$x^2 - 9y^2 = 0$

$x^2 = 9y^2$

$\Rightarrow x = 3y$ if $x, y > 0$

$\therefore \quad x : y$

$= 3 : 1$

$3 : 1$

(3)

(b) Simplify fully $\dfrac{3 - 4x - 4x^2}{2x^2 - 7x + 3}$

$= \dfrac{(3 + 2x)(1 - 2x)}{(2x - 1)(x - 3)}$

$= \dfrac{(3 + 2x)(1 - 2x)}{(1 - 2x)(3 - x)}$

$= \dfrac{3 + 2x}{3 - x}$

(3)

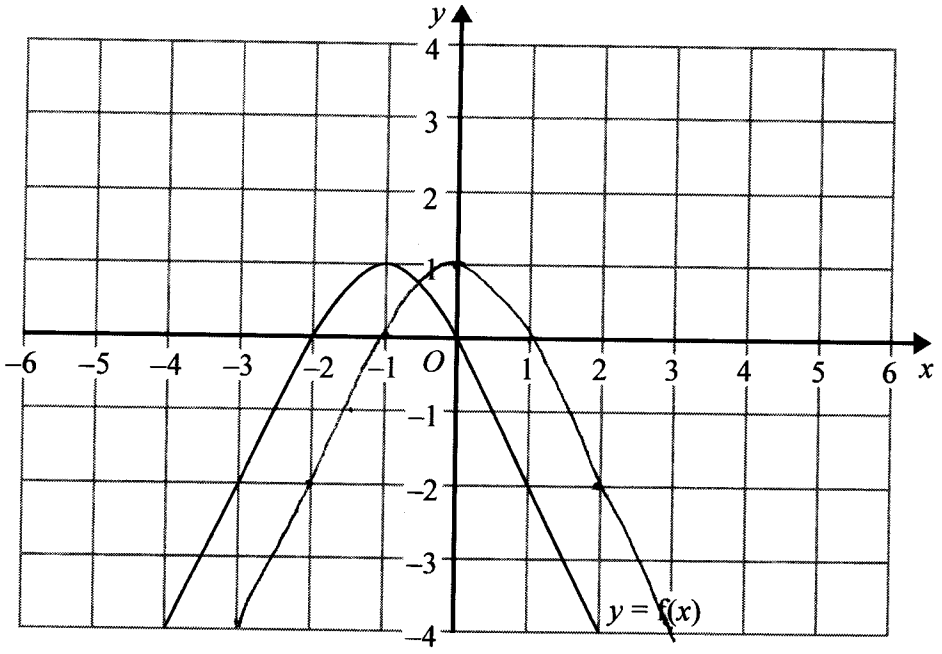
**(Total for Question 17 is 6 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**18** The graph of $y = f(x)$ is shown on the grid.




(a) On the grid, sketch the graph of $y = f(x - 1)$

**(1)**

The graph of $y = f(x)$ has a turning point at the point $(-1, 1)$

(b) Write down the coordinates of the turning point of the graph of $y = f(-x) + 2$

( 1 , 3 )

**(1)**

**(Total for Question 18 is 2 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**19** $\dfrac{1+\sqrt{2}}{(3-\sqrt{2})^2}$ can be written in the form $a + b\sqrt{2}$

Find the value of $a$ and the value of $b$.

$$= \frac{1+\sqrt{2}}{9-6\sqrt{2}+2} = \frac{1+\sqrt{2}}{11-6\sqrt{2}}$$

$$= \frac{1+\sqrt{2}}{11-6\sqrt{2}} \times \frac{11+6\sqrt{2}}{11+6\sqrt{2}}$$

$$= \frac{11+11\sqrt{2}+6\sqrt{2}+12}{11^2-(6\sqrt{2})^2}$$

$$= \frac{23+17\sqrt{2}}{121-72}$$

$$= \frac{23+17\sqrt{2}}{49}$$

$$= \frac{23}{49} + \frac{17}{49}\sqrt{2}$$

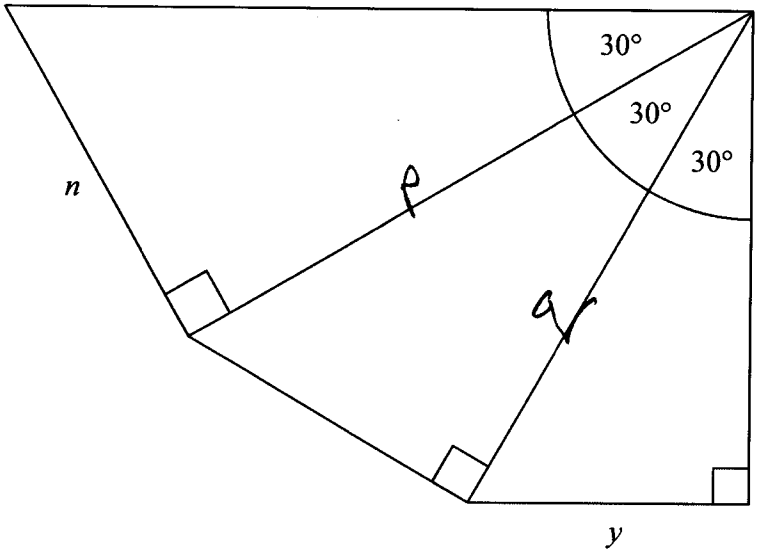
$a =$ $\frac{23}{49}$

$b =$ $\frac{17}{49}$

**(Total for Question 19 is 5 marks)**

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

**20**




The diagram shows three right-angled triangles.

Prove that $y = \frac{3}{4}n$

$\tan 30 = \frac{n}{p} \Rightarrow \frac{1}{\sqrt{3}} = \frac{n}{p}$

$p = \sqrt{3}n$

$\cos 30 = \frac{q}{p} \Rightarrow \frac{\sqrt{3}}{2} = \frac{q}{p}$

$\frac{\sqrt{3}p}{2} = q$

$\frac{\sqrt{3} \times \sqrt{3}n}{2} = q$

$\frac{3n}{2} = q$

$\sin 30 = \frac{y}{q} \Rightarrow \frac{1}{2} = \frac{y}{\frac{3n}{2}} \Rightarrow y = \frac{3n}{2} \times \frac{1}{2}$

$y = \frac{3n}{4}$

**(Total for Question 20 is 4 marks)**

**TOTAL FOR PAPER IS 80 MARKS**