DB Solutions

| Candidate surname | Other names |
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BennettMaths
Engaging Learners

# Best Guess Paper – Non-Calculator Higher Tier

**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 75.
- 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.

**Q1.**

(a) Work out $2\frac{1}{7}+1\frac{1}{4}$

$\times 4\ \frac{15}{7} + \frac{5}{4}\ \times 7$

$\times 4\ \ 7 \qquad 4 \times 7$

$\frac{60}{28} + \frac{35}{28} = \frac{95}{28}$

28

.....

**(2)**

(b) Work out $1\frac{1}{5}\div\frac{3}{4}$

Give your answer as a mixed number in its simplest form.

$\frac{6}{5} \div \frac{3}{4}$

$\frac{6}{5} \times \frac{4}{3} = \frac{24}{15} = 1\frac{9}{15} = 1\frac{3}{5}$

.....

**(2)**

**(Total for question = 4 marks)**

**Q2.**

(a) Write 168 as a product of its prime factors.
You must show your working.

168
2 84
2 42
2 21
3 7

$2^3 \times 3 \times 7$

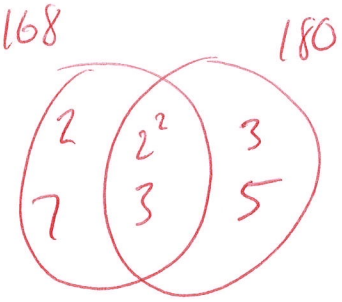
.....

(3)

(b) Find the highest common factor (HCF) of 168 and 180

180
2 90
2 45
5 9
3 3

$2^2 \times 3^2 \times 5$




$2^2 \times 3 = 12$

.....

(2)

**(Total for question = 5 marks)**

**Q3.**

Work out 0.004 × 0.32

$32 \times 4 = 128$

0.00128

0.00128

.....

**(Total for question = 2 marks)**

**Q4.**

+ ×

Factorise $x^2 + 3x - 4$

$(x+4)(x-1)$

.....

**(Total for question is 2 marks)**

**Q5.**

Chris, Debbie and Errol share some money in the ratio 3 : 4 : 2
Debbie gets £120

Chris then gives some of his share to Debbie and some of his share to Errol.
The money that Chris, Debbie and Errol each have is now in the ratio 2 : 5 : 3

How much money did Chris give to Errol?

C : D : E
3 : 4 : 2 ) ×30
×30 ( 90 : 120 : 60 )
£270

2+5+3=10

$\frac{270}{10} = 27$

2 : 5 : 3
54 : 135 : 81 ) ×27

81 − 60 = 21

£ 21

**(Total for question = 4 marks)**

**Q6.**

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

$\frac{3^9}{3^2} = 3^7$

.....

**(2)**

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

1

.....

**(1)**

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

$3^2 = 9$

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

$\frac{1}{9}$

.....

**(1)**

**(Total for question = 4 marks)**

**Q7.**

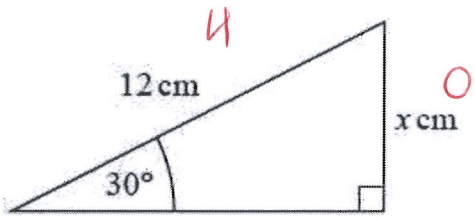
(a) Write down the exact value of cos30°

$\frac{\sqrt{3}}{2}$

.....

(1)

(b)




Given that sin30° = 0.5,
work out the value of $x$.

$\sin(30) = \frac{x}{12}$

$\sin(30) \times 12 = x$

$\frac{1}{2} \times 12 = x$

$6 = x$

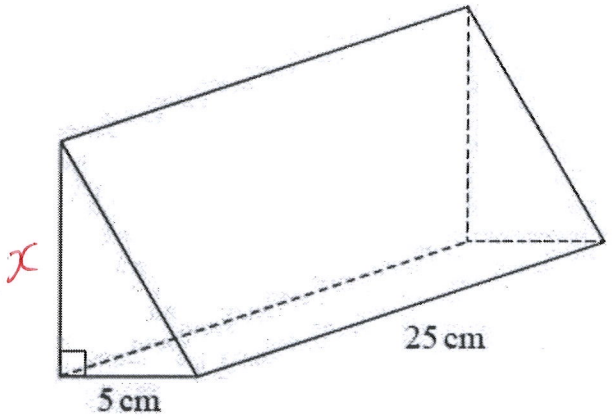
.....

(2)

**(Total for question is 3 marks)**

**Q8.**

The diagram shows a prism.




The cross section of the prism is a right-angled triangle.
The base of the triangle has length 5 cm

The prism has length 25 cm
The prism has volume 750 $cm^3$

Work out the height of the prism.

$$\frac{x \times 5}{2} \times 25 = 750$$

$$\frac{5x}{2} = 30$$

$$5x = 60$$

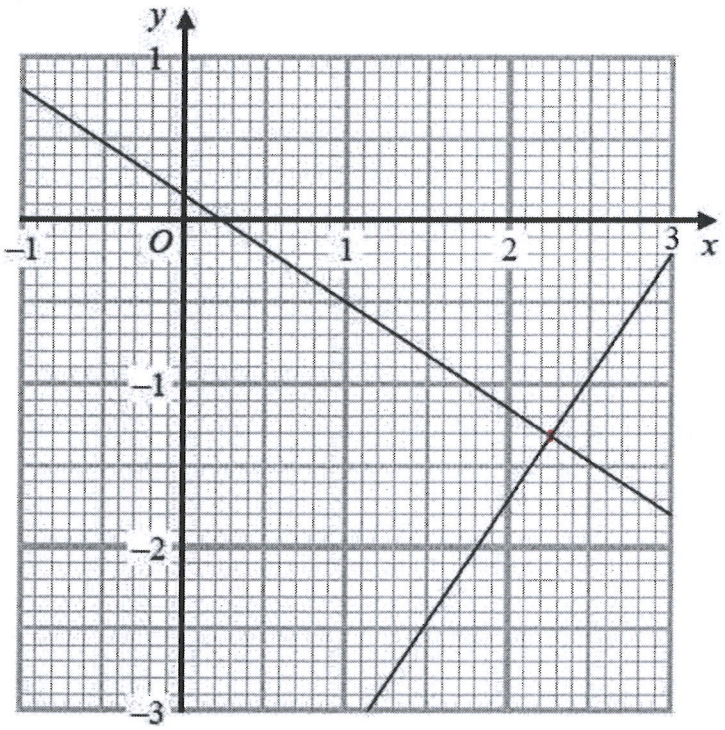
$$x = 12$$

..... cm

**(Total for question = 3 marks)**

**Q9.**

The graphs with equations $3y + 2x = \frac{1}{2}$ and $2y - 3x = -\frac{113}{12}$ have been drawn on the grid below.




Using the graphs, find estimates of the solutions of the simultaneous equations

$$3y + 2x = \frac{1}{2}$$

$$2y - 3x = -\frac{113}{12}$$

$x$ = 2·25

$y$ = −1·3

**(Total for question = 2 marks)**

**Q10.**

Here is a cuboid.

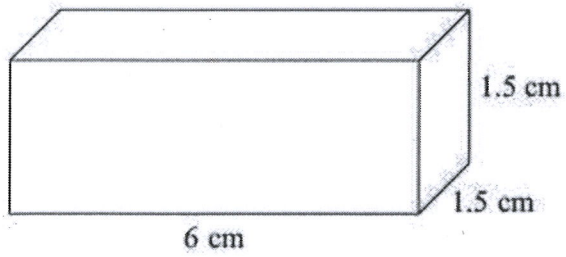



Diagram **NOT** accurately drawn

The cuboid is 6 cm by 1.5 cm by 1.5 cm.

Work out the total surface area of the cuboid.

F+B = 6 × 1.5 = 9
9 × 2 = (18)

T+B = 6 × 1.5 = 9
9 × 2 = (18)

L+R = 1.5 × 1.5 = 2.25
2.25 × 2 = (4.5)

18 + 18 + 4.5 = 40.5

..... $cm^2$

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

**Q11.**

Prove algebraically that the recurring decimal $0.3\dot{1}\dot{8}$ can be written as $\frac{7}{22}$

$x = 0.3\dot{1}\dot{8}$
$10x = 3.\dot{1}\dot{8}$
$100x = 31.\dot{8}\dot{1}$
$1000x = 318.\dot{1}\dot{8}$

$1000x - 10x = 990x$
$318.\dot{1}\dot{8} - 3.\dot{1}\dot{8} = 315$

$990x = 315$
$x = \frac{315}{990} = \frac{7}{22}$
$\div 45$

**(Total for question = 2 marks)**

**Q12.**

(a) Write down the value of $64^{\frac{1}{2}}$

$\sqrt{64} = 8$

.....

(1)

(b) Find the value of $\left(\frac{8}{125}\right)^{-\frac{2}{3}}$

$\left(\sqrt[3]{\frac{8}{125}}\right)^{2}$ $\qquad$ $\left(\frac{4}{25}\right)^{-1} = \frac{25}{4}$

$\left(\frac{2}{5}\right)^{2} = \frac{4}{25}$

.....

(2)

**(Total for question = 3 marks)**

**Q13.**

Make *a* the subject of $a + 3 = \frac{2a + 7}{r}$

$ar + 3r = 2a + 7$

$ar + 3r - 2a = 7$

$ar - 2a = 7 - 3r$

$a(r - 2) = 7 - 3r$

$a = \frac{7 - 3r}{r - 2}$

.....

**(Total for question = 3 marks)**

**Q14.**

* The diagram shows a triangle inside a rectangle.

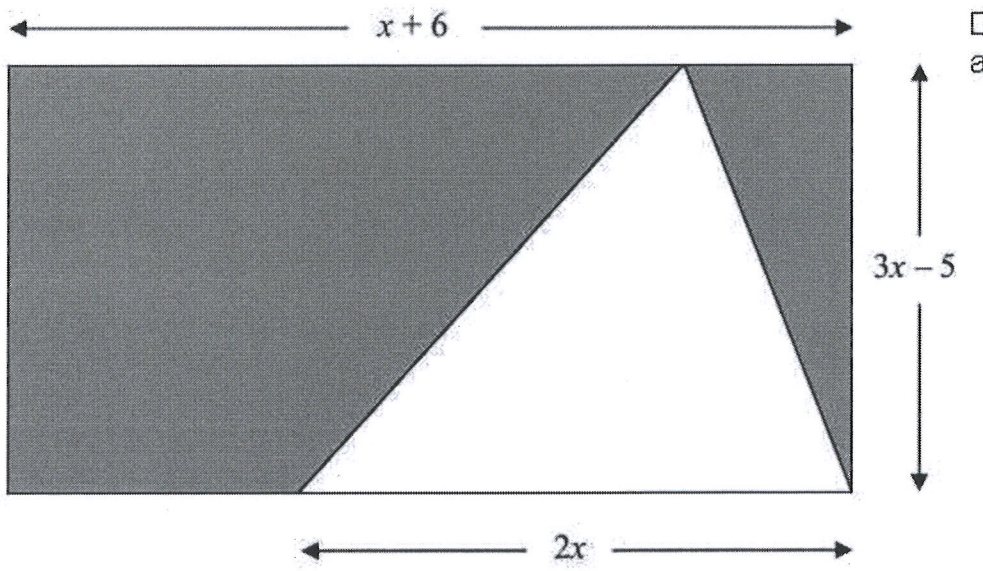
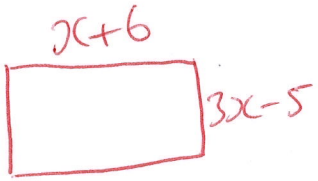
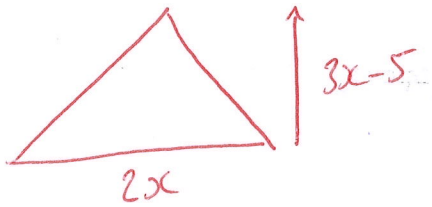



Diagram **NOT** accurately drawn

All measurements are given in centimetres.

Show that the total area, in $cm^2$, of the shaded regions is $18x - 30$




$(x+6)(3x-5)$

$= 3x^2 + 13x - 30$

$\frac{1}{2} \times 2x(3x-5)$

$= x(3x-5)$

$= 3x^2 - 5x$

$(3x^2 + 13x - 30) - (3x^2 - 5x)$

$3x^2 - 3x^2 = 0$

$13x - -5x = 18x$

$-30 - 0 = -30$

$18x - 30$

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

**Q15.**

Given that

$$2x - 1 : x - 4 = 16x + 1 : 2x - 1$$

find the possible values of $x$.

$$\frac{2x-1}{x-4} = \frac{16x+1}{2x-1}$$

$$(2x-1)(2x-1) = (16x+1)(x-4)$$

$$4x^2 - 4x + 1 = 16x^2 - 63x - 4$$

$$-4x + 1 = 12x^2 - 63x - 4$$

$$1 = 12x^2 - 59x - 4$$

$$0 = 12x^2 - 59x - 5$$

$-60$ $\quad x = -60$, $+ = -59$

$-60, 1$

$$12x^2 - 60x + 1x - 5$$

$$12x(x-5) \quad 1(x-5)$$

$$(12x+1)(x-5)$$

$$x = -\frac{1}{12} \qquad x = 5$$

.....

**(Total for question = 5 marks)**

**Q16.**

Here is a trapezium.

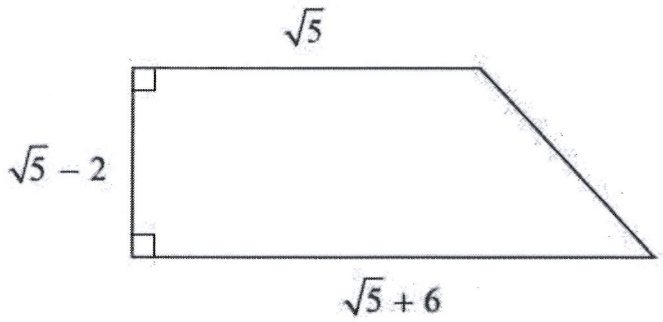



Diagram **NOT** accurately drawn

All measurements shown are in centimetres.

Work out the area of the trapezium.
Give your answer in $cm^2$ in the form $a\sqrt{5} + b$ where $a$ and $b$ are integers.

$\frac{1}{2}(\sqrt{5}+\sqrt{5}+6) \times \sqrt{5}-2$

$\frac{1}{2}(2\sqrt{5}+6)(\sqrt{5}-2)$

$(\sqrt{5}+3)(\sqrt{5}-2)$

$5-2\sqrt{5}+3\sqrt{5}-6$

$1\sqrt{5}-1$

.....$cm^2$

**(Total for question = 3 marks)**

**Q17.**

There are 17 men and 26 women in a choir.
The choir is going to sing at a concert.

One of the men and one of the women are going to be chosen to make a pair to sing the first song.

(a) Work out the number of different pairs that can be chosen.

$17 \times 26 = 442$

.....

(2)

Two of the men are to be chosen to make a pair to sing the second song.

Ben thinks the number of different pairs that can be chosen is 136
Mark thinks the number of different pairs that can be chosen is 272

(b) Who is correct, Ben or Mark?
Give a reason for your answer.

Mark, as Ben hasn't accounted for any duplicates

(1)

**(Total for question = 3 marks)**

**Q18.**

Given that $9^{-\frac{1}{2}} = 27^{\frac{1}{4}} \div 3^{x+1}$
find the exact value of $x$.

$(3^2)^{-\frac{1}{2}} = (3^3)^{\frac{1}{4}} \div 3^{x+1}$

$3^{-1} = 3^{\frac{3}{4}} \div 3^{x+1}$

$-1 = \frac{3}{4} - (x+1)$

$-1 = \frac{3}{4} - x - 1$

$-1 = -\frac{1}{4} - x$

$x - 1 = -\frac{1}{4}$

$x = \frac{3}{4}$

$x =$ .....

**(Total for question = 3 marks)**

**Q19.**
The centre of a circle is the point with coordinates (−1, 3)

The point $A$ with coordinates (6, 8) lies on the circle.

Find an equation of the tangent to the circle at $A$.
Give your answer in the form $ax + by + c = 0$ where $a$, $b$ and $c$ are integers.

gradient of radius $= \frac{8-3}{6--1} = \frac{5}{7}$

gradient of tangent $= -\frac{7}{5}$

$y = -\frac{7}{5}x + c$ $(x, y)$ $(6, 8)$

$8 = -\frac{7}{5} \times 6 + c$

$8 = -\frac{42}{5} + c$

$\frac{40}{5} = -\frac{42}{5} + c$

$c = \frac{82}{5}$

$y = -\frac{7}{5}x + \frac{82}{5}$

$5y = -7x + 82$

$7x + 5y - 82 = 0$

.....

**(Total for question = 4 marks)**

**Q20.**

$\sqrt{8} = 2\sqrt{2}$

Show that $\frac{3+\sqrt{2}}{5+\sqrt{8}}$ can be written as $\frac{11-\sqrt{2}}{17}$

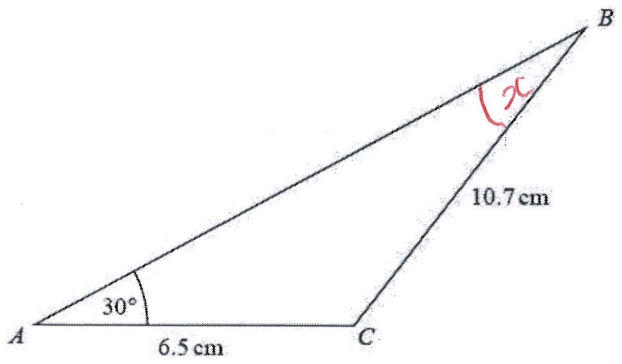
$$\frac{3+\sqrt{2}}{5+\sqrt{8}} \times \frac{5-\sqrt{8}}{5-\sqrt{8}} = \frac{(3+\sqrt{2})(5-\sqrt{8})}{(5+\sqrt{8})(5-\sqrt{8})} = \frac{15-3\sqrt{8}+5\sqrt{2}-4}{25+5\sqrt{8}-5\sqrt{8}-8}$$

$$\frac{11+5\sqrt{2}-3\sqrt{8}}{17} = \frac{11+5\sqrt{2}-3\times 2\sqrt{2}}{17} = \frac{11+5\sqrt{2}-6\sqrt{2}}{17} = \frac{11-\sqrt{2}}{17}$$

**(Total for question = 3 marks)**

**Q21.**

Here is a triangle *ABC*.




Work out the value of sin *ABC*

Give your answer in the form $\frac{m}{n}$ where *m* and *n* are integers.

$$\frac{\sin(x)}{6.5} = \frac{\sin(30)}{10.7}$$

$$\sin(x) = \frac{\sin(30) \times 6.5}{10.7}$$

$$= \frac{\frac{1}{2} \times 6.5}{10.7}$$

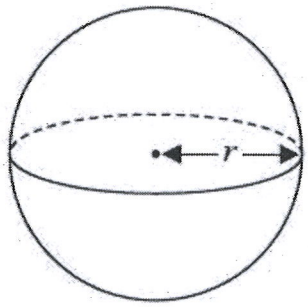
$$\frac{3.25}{10.7} = \frac{325}{1070}$$

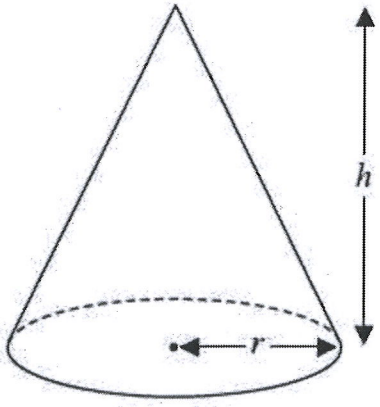
.....

**(Total for question = 4 marks)**

**Q22.**

Here is a solid sphere and a solid cone.




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

Volume of cone $= \frac{1}{3}\pi r^2 h$

All measurements are in cm.

The volume of the sphere is equal to the volume of the cone.

(a) Find $r : h$

Give your answer in its simplest form.

$\frac{4\pi r^3}{3} = \frac{\pi r^2 h}{3}$

$4\pi r^3 = \pi r^2 h$

$4r^3 = r^2 h$

$4r = h$

$4 : 1$

.....

(2)

**(Total for question = 2 marks)**

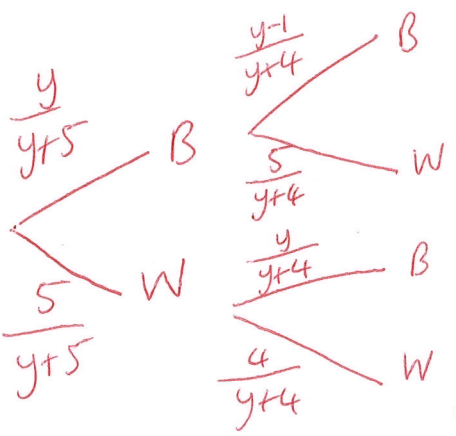
**Q23.**

There are $y$ black socks and 5 white socks in a drawer.

Joshua takes at random two socks from the drawer.

The probability that Joshua takes one white sock and one black sock is $\frac{6}{11}$

(a) Show that $3y^2 - 28y + 60 = 0$




$\frac{y}{y+5} \times \frac{5}{y+4} = \frac{5y}{(y+5)(y+4)}$

$\frac{5}{y+5} \times \frac{y}{y+4} = \frac{5y}{(y+5)(y+4)}$ } $+ \frac{10y}{y^2+9y+20}$

$\frac{10y}{y^2+9y+20} \times \frac{6}{11}$

$110y = 6y^2 + 54y + 120$

$0 = 6y^2 - 56y + 120$

$0 = 3y^2 - 28y + 60$

(4)

(b) Find the probability that Joshua takes two black socks.

$3y^2 - 28y + 60 = 0$

$180$

$x = 180$

$+ = -28$

$-18, -10$

$3y^2 - 18y - 10y + 60 = 0$

$3y(y-6) - 10(y-6)$

$(3y-10)(y-6) = 0$

$y = \frac{10}{3}$ $y = 6$

$\frac{6}{11} \times \frac{5}{10} = \frac{30}{110}$

.....

(3)

**(Total for question = 7 marks)**