Write your name here

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Pearson Edexcel
International GCSE

Centre Number | Candidate Number

Mathematics A

Level 1/2
Paper 2H

Higher Tier

Thursday 7 June 2018 – Morning
Time: 2 hours

Paper Reference
4MA1/2H

You must have:
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. 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.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – there may be more space than you need.
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

Turn over ▶

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1/1/1/

P 5 4 6 9 5 A 0 1 2 4

Pearson

International GCSE Mathematics

Formulae sheet – Higher Tier

Arithmetic series

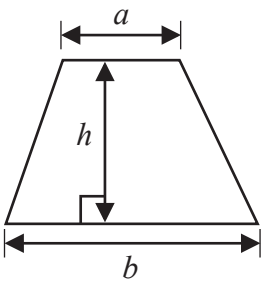
Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

The quadratic equation

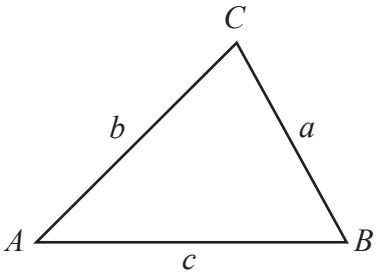
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Area of trapezium $= \frac{1}{2}(a+b)h$



Trigonometry



In any triangle ***ABC***

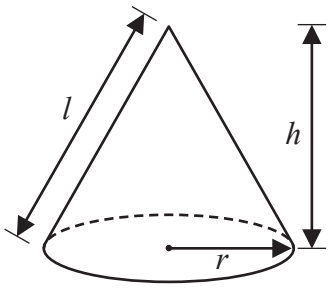
Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

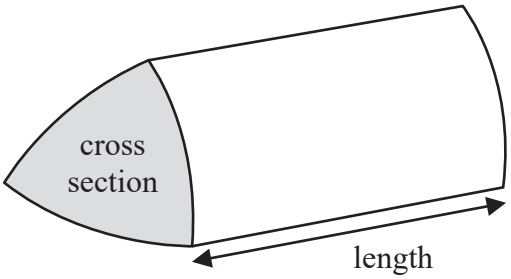
Area of triangle $= \frac{1}{2}ab\sin C$

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

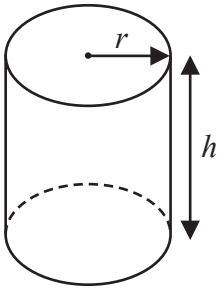
Curved surface area of cone $= \pi rl$



Volume of prism
= area of cross section × length

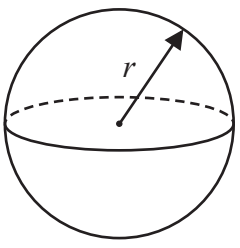


Volume of cylinder $= \pi r^2 h$
Curved surface area of cylinder $= 2\pi rh$



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

Surface area of sphere $= 4\pi r^2$



Answer ALL TWENTY THREE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Make a the subject of the formula $M = ac - bd$

$M = ac - bd$

$ac = M + bd$

$a = \frac{M+bd}{c}$

$a = \frac{M+bd}{c}$

(2)

(b) Solve the inequality $5x - 4 < 39$

$5x - 4 < 39$

$5x < 39 + 4$

$5x < 43$

$x < \frac{43}{5}$

$x < \frac{43}{5}$

(2)

(c) Factorise fully $18e^2f^3 - 12e^3f$

$6e^2f(3f^2 - 2e)$

(2)

(Total for Question 1 is 6 marks)

2 Work out the difference between the largest share and the smallest share when 3450 yen is divided in the ratios 2 : 6 : 7

1st	:	2nd	:	3rd	:	Total
2	:	6	:	7	:	15
?	:	?	:	?	:	3450

Largest share = $\frac{3450 \times 7}{15}$ = 1610 yen

Smallest share = $\frac{3450 \times 2}{15}$ = 460 yen

Difference = 1610 − 460 = 1150

1150 ..... yen

(Total for Question 2 is 3 marks)

3 Gopal is paid 20 000 rupees each month.
Jamuna is paid 19 200 rupees each month.

Gopal and Jamuna are both given an increase in their monthly pay.
After the increase, they are both paid the same amount each month.

Gopal was given an increase of 8%

Work out the percentage increase that Jamuna was given.

For Gopal:

Original	:	Increase	:	New
100	:	8	:	108
20000	:	?	:	?

New = $\frac{20000 \times 108}{100}$ = 21600 rupees

For Jamuna :-

Percentage increase = $\frac{21600 - 19200}{19200} \times 100$ = 12.5%

12.5 ..... %

(Total for Question 3 is 4 marks)

4 Show that $3\frac{4}{7} - 1\frac{5}{8} = 1\frac{53}{56}$

$= \frac{25 \times 8}{7 \times 8} - \frac{13 \times 7}{8 \times 7}$

$= \frac{200}{56} - \frac{91}{56}$

$= \frac{109}{56}$

$= \boxed{1\frac{53}{56}}$

(Total for Question 4 is 3 marks)

5 In the diagram below, P and Q are points on a circle with centre O.

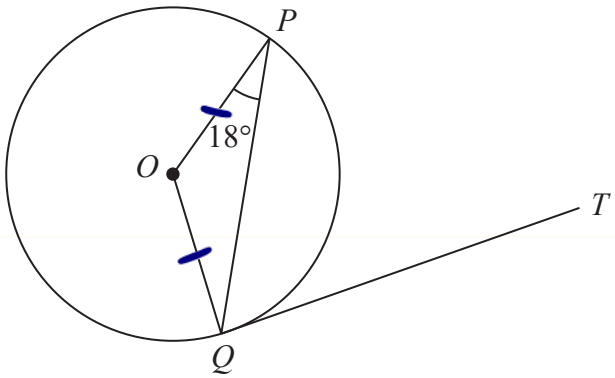


Diagram **NOT** accurately drawn

QT is a tangent to the circle.
Angle $OPQ = 18°$

Work out the size of angle PQT.
Give a reason for each stage of your working.

angle OQP = 18° (POQ is isosceles △)

angle OQT = 90° (angle between radius and tangent)

angle PQT = 90° − 18° = 72°

72° °

(Total for Question 5 is 3 marks)

6 The diagram shows two cylinders, **A** and **B**.

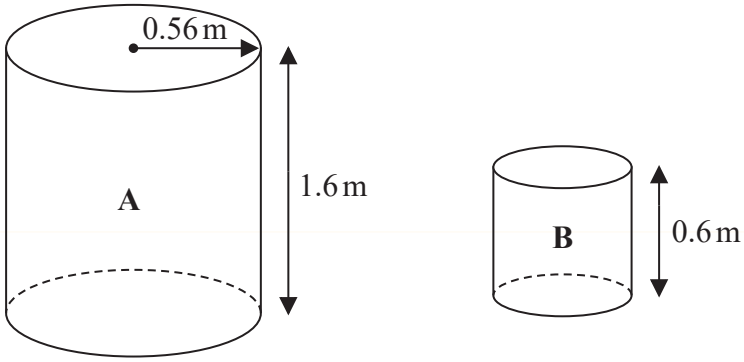


Diagram **NOT** accurately drawn

Cylinder **A** has height 1.6 m and radius 0.56 m.

(a) Work out the curved surface area of cylinder **A**.
Give your answer in m^2 correct to 3 significant figures.

Curved area = $2\pi rh$

$= 2 \times \pi \times 0.56 \times 1.6$

$= 5.629...$

5.63 m^2

(2)

Cylinder **B** is mathematically similar to cylinder **A**.
The height of cylinder **B** is 0.6 m.

(b) Work out the radius of cylinder **B**.

$\frac{r_A}{r_B} = \frac{h_A}{h_B}$

$\frac{0.56}{r_B} = \frac{1.6}{0.6}$

$r_B = \frac{0.56 \times 0.6}{1.6}$

$r_B = 0.21$

0.21 m

(2)

(Total for Question 6 is 4 marks)

7 The students in Class A and in Class B take the same examination.

There are 28 students in Class A and 32 students in Class B.
The mean score for all the students in both classes is 72.6
The mean score for the students in Class A is 75

(a) Work out the mean score for the students in Class B.

$$\text{mean for class A} = \frac{\text{Sum}}{\text{No.}}$$

$$75 = \frac{\text{Sum}(A)}{28}$$

$$\text{Sum}(A) = 75 \times 28$$

$$\text{Sum}(A) = 2100$$

$$\text{Mean for all} = \frac{S_A + S_B}{28+32}$$

$$72.6 = \frac{2100 + S_B}{60}$$

$$2100 + S_B = 4356$$

$$S_B = 2256$$

$$\text{mean}(B) = \frac{2256}{32}$$

$$70.5$$

(4)

The lowest score in Class A is 39
The range of scores for Class A is 57
The lowest score in Class B is 33
The range of scores for Class B is 60

(b) Find the range of scores for all the students in both classes.

$$\text{Range}(A) = \text{Greatest} - \text{smallest}$$

$$57 = \text{Greatest} - 39$$

$$\text{Greatest} = 57 + 39 = 96$$

$$\text{Range}(B) = \text{Greatest} - \text{smallest}$$

$$60 = \text{Greatest} - 33$$

$$\text{Greatest} = 93$$

Range for all:

$$\text{Greatest} - \text{smallest}$$

$$= 96 - 33$$

$$= 63$$

$$63$$

(3)

(Total for Question 7 is 7 marks)

8

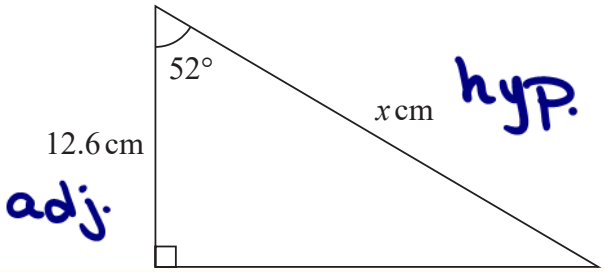


Diagram **NOT** accurately drawn

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

$\cos 52° = \frac{12.6}{x}$

$x = \frac{12.6}{\cos 52°} = 20.46\ldots$

$x = 20.5°$ (3 s.f.)

$x =$ 20.5

(Total for Question 8 is 3 marks)

9 Solve the simultaneous equations

$x + y = 15$ ×5
$7x - 5y = 3$

Show clear algebraic working.

$5x + 5y = 75$
$7x - 5y = 3$

by adding

$12x = 78$

$x = 6.5$

$y = 15 - x$

$y = 15 - 6.5 \longrightarrow y = 8.5$

$x =$ 6.5

$y =$ 8.5

(Total for Question 9 is 3 marks)

10 $\dfrac{8}{2^7} = 2^n$

(a) Find the value of n.

$\dfrac{2^3}{2^7} = 2^n$ | $2^{3-7} = 2^n$

$2^{-4} = 2^n$

$n =$ **−4**

(2)

$(13^{-6})^4 \times 13^5 = 13^k$

(b) Find the value of k.

$13^{-24} \times 13^5 = 13^k$ | $13^{-19} = 13^k$

$13^{-24+5} = 13^k$ | $k = -19$

$k =$ **−19**

(2)

(Total for Question 10 is 4 marks)

11 A solid metal sphere has radius 1.5 cm.
The mass of the sphere is 109.6 grams.

Work out the density of the sphere.
Give your answer correct to 3 significant figures.

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

$V = \frac{4}{3} \times \pi \times (1.5)^3$

$V = \frac{9}{2}\pi$

Density $= \frac{\text{mass}}{\text{volume}} = \frac{109.6}{4.5\pi} = 7.75$

7.75 g/cm^3

(Total for Question 11 is 3 marks)

12

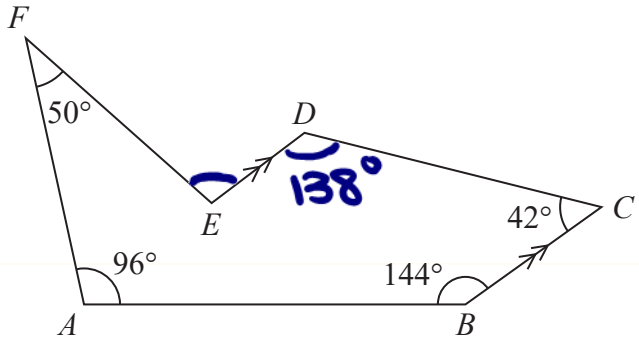


Diagram **NOT** accurately drawn

The diagram shows a hexagon *ABCDEF*.
BC is parallel to *ED*.

Work out the size of the obtuse angle *DEF*.

angle DEC = 180° − 42° = 138°

Sum of angles in hexagon = 720°

Reflex angle DEF =

720° − (50° + 96° + 144° + 42° + 138°)

Reflex angle DEF = 250°

obtuse angle DEF = 360° − 250°

= 110°

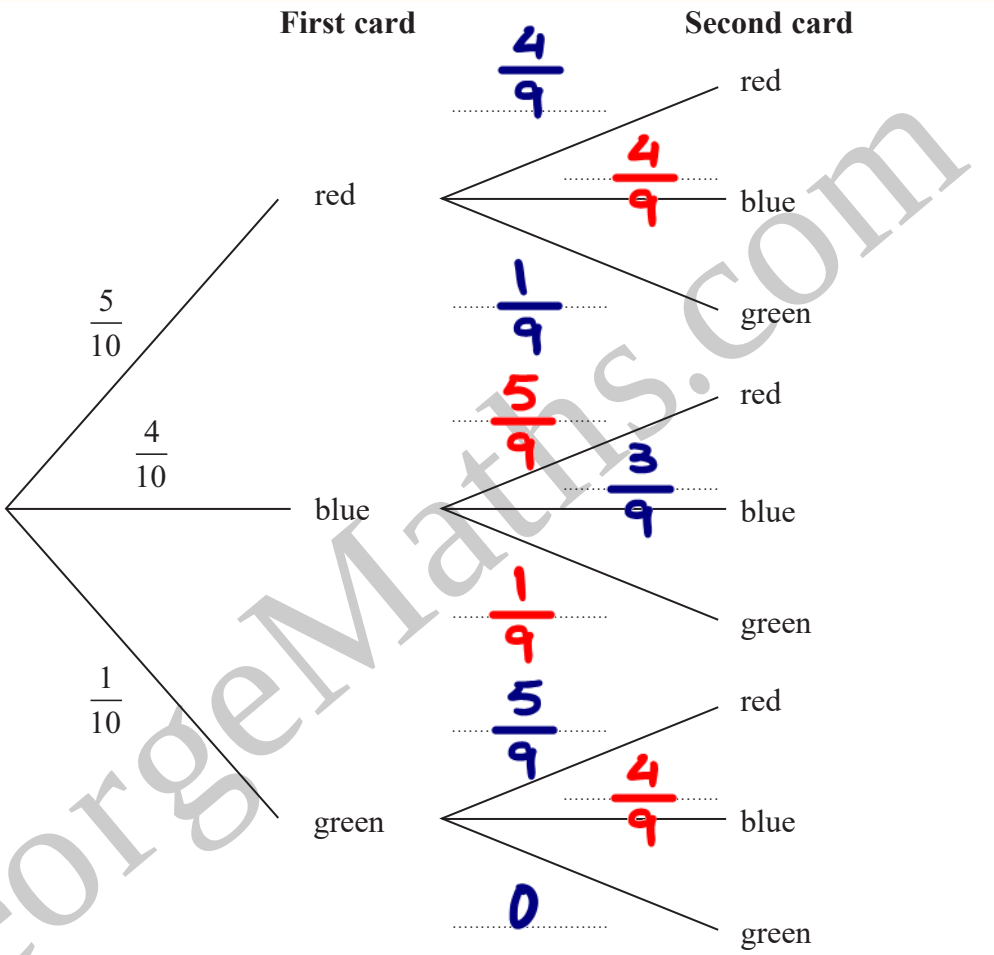
110 °

(Total for Question 12 is 5 marks)

13 Felix has 10 cards.
There are 5 red cards, 4 blue cards and 1 green card.

Felix takes at random one of the cards.
He does not replace the card.
Felix then takes at random a second card.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Felix takes at least one blue card and no green card.

$P(R \& B)$ or $P(BBR)$ or $P(BBB)$

$= \left(\frac{5}{10} \times \frac{4}{9}\right) + \left(\frac{4}{10} \times \frac{5}{9}\right) + \left(\frac{4}{10} \times \frac{3}{9}\right)$

$= \frac{20}{90} + \frac{20}{90} + \frac{12}{90} = \frac{52}{90} = \boxed{\frac{26}{45}}$

(3)

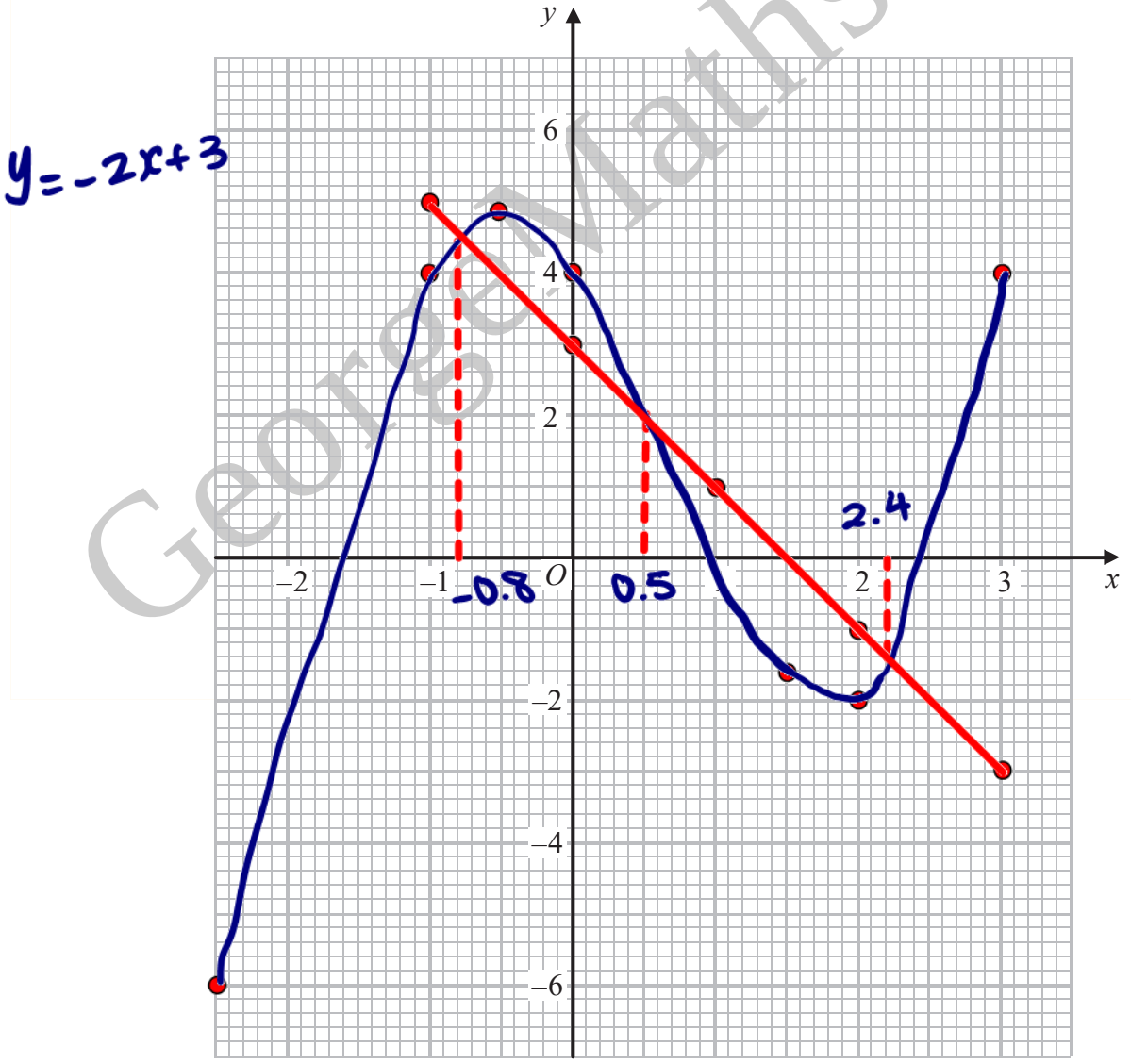
(Total for Question 13 is 5 marks)

14 (a) Complete the table of values for $y = x^3 - 2x^2 - 3x + 4$

x	–2	–1	–0.5	0	1	1.5	2	3
y	−6	4	4.875	4	0	–1.625	−2	4

(2)

(b) On the grid, draw the graph of $y = x^3 - 2x^2 - 3x + 4$ for values of x from –2 to 3



(2)

(c) By drawing a suitable straight line on the grid,
find estimates for the solutions of the equation $x^3 - 2x^2 - x + 1 = 0$
Give your solutions correct to 1 decimal place.

suitable straight line =

Original eq. — New eq.

$= x^3 - 2x^2 - 3x + 4 - (x^3 - 2x^2 - x + 1)$

$= x^3 - 2x^2 - 3x + 4 - x^3 + 2x^2 + x - 1$

$= -2x + 3$

Draw line $-2x + 3$ & identify Points of intersection with drawn curve.

-0.8, 0.5, 2.4

(4)

(Total for Question 14 is 8 marks)

15 $e = 8.31$ correct to 2 decimal places $0.01 \div 2 = 0.005$
$f = 0.65$ correct to 2 decimal places $0.01 \div 2 = 0.005$

Work out the lower bound for the value of $e - f$
Show your working clearly.

Lower bound of $e - f = e_{LB} - f_{UB}$

$e_{LB} = 8.31 - 0.005 = 8.305$

$F_{UB} = 0.65 + 0.005 = 0.655$

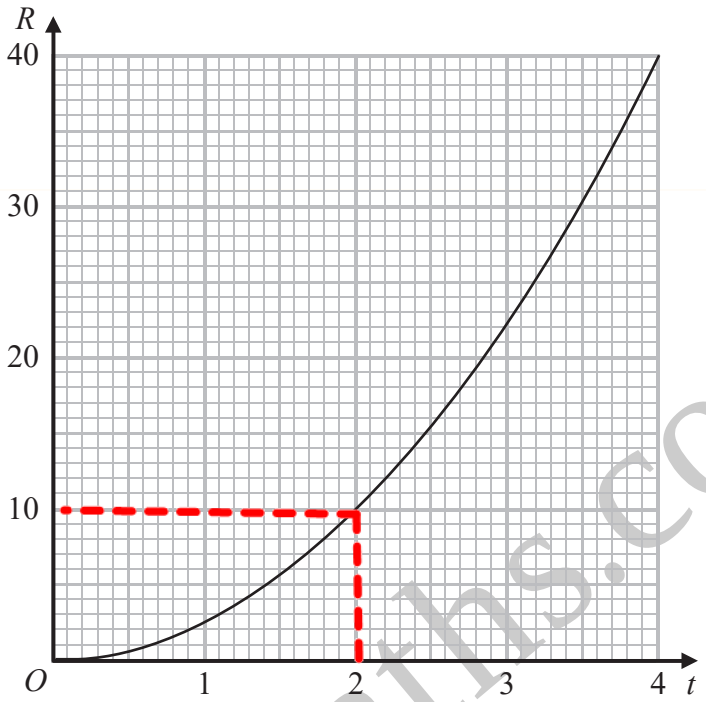
$e_{LB} - F_{UB} = 8.305 - 0.655 = 7.65$

7.65

(Total for Question 15 is 2 marks)

16 R is proportional to t^2

The graph shows the relationship between R and t for $0 \leqslant t \leqslant 4$



(a) Find a formula for R in terms of t.

$R = kt^2$

$10 = k(2)^2$

$10 = 4k$

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

$k = \frac{5}{2}$

$R = \frac{5}{2}t^2$

(3)

Given also that $R = \frac{8}{5x}$

(b) show that t is inversely proportional to $\sqrt{x}$ for $t > 0$

$$R = \frac{8}{5x}$$

$$\frac{5}{2}t^2 = \frac{8}{5x}$$

$$25xt^2 = 16$$

$$t^2 = \frac{16}{25x}$$

$$t = \sqrt{\frac{16}{25x}} = \frac{4}{5\sqrt{x}} \longmapsto$$

t is inversely to $\sqrt{x}$

(2)

(Total for Question 16 is 5 marks)

17 $y = x^3 - 2x^2 - 15x + 5$

(a) Find $\frac{dy}{dx}$

$y = x^3 - 2x^2 - 15x + 5$

$\frac{dy}{dx} = 3x^2 - 4x - 15$

(2)

C is the curve with equation $y = x^3 - 2x^2 - 15x + 5$

(b) Work out the range of values of x for which **C** has a negative gradient.

negative gradient $\longrightarrow \frac{dy}{dx} < 0$

$3x^2 - 4x - 15 < 0$

$(3x + 5)(x - 3) < 0$

$-\frac{5}{3} < x < 3$

$-\frac{5}{3} < x < 3$

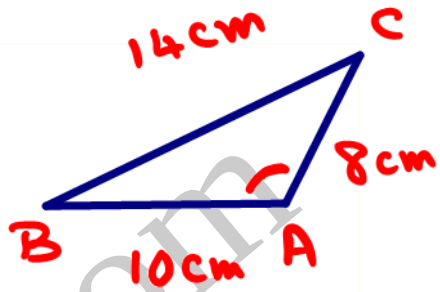
(4)

(Total for Question 17 is 6 marks)

18 A triangle has sides of length 8 cm, 10 cm and 14 cm.

Work out the size of the largest angle of the triangle.
Give your answer correct to 1 decimal place.

Largest angle opposite to the longest side.



Using Cosine rule:-

$$\cos A = \frac{10^2 + 8^2 - 14^2}{2 \times 10 \times 8}$$

$$A = \cos^{-1}\left(\frac{10^2 + 8^2 - 14^2}{2 \times 10 \times 8}\right)$$

$A = 101.536\ldots$

101.5°

(Total for Question 18 is 3 marks)

19 The diagram shows a triangular prism.

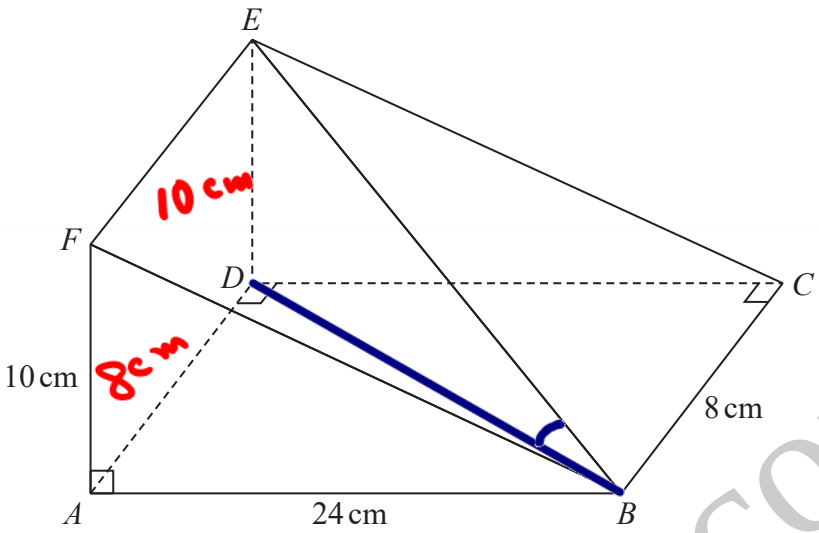


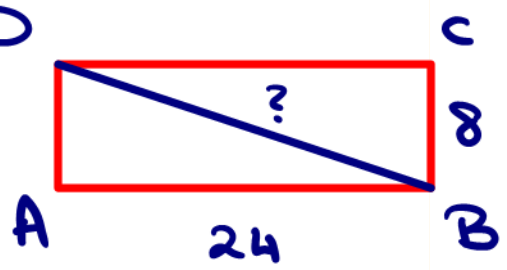
Diagram **NOT** accurately drawn

$AF = 10$ cm, $AB = 24$ cm and $BC = 8$ cm.
Angle FAB = angle ADC = angle $BCD = 90°$

Work out the size of the angle between the line BE and the plane $ABCD$.
Give your answer correct to 1 decimal place.

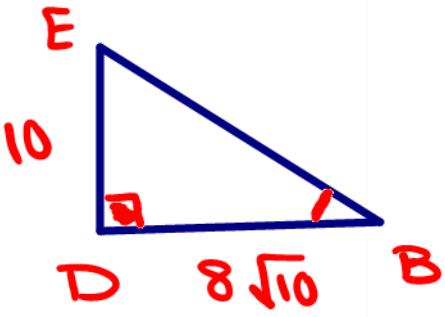
$BD = \sqrt{24^2 + 8^2}$

$BD = 8\sqrt{10}$ cm.



The required angle is $\angle EBD$

$\tan EBD = \frac{10}{8\sqrt{10}}$



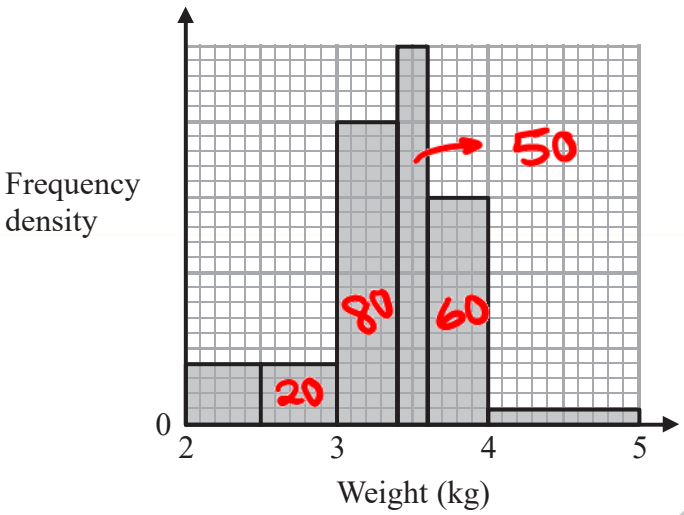
$\text{angle } EBD = \tan^{-1}\left(\frac{10}{8\sqrt{10}}\right)$

$\text{angle } EBD = 21.568\ldots$

21.6°

(Total for Question 19 is 3 marks)

20 The histogram shows information about the birth weights of some babies.



6 of these babies had a birth weight less than 2.5 kg or greater than 4 kg.

Work out the number of babies who had a birth weight between 2.5 kg and 4 kg.

30 small squares : 6 babies

Total no. of squares between 2.5 kg & 4 kg

= 20 + 80 + 50 + 60 = 210 small squares

30 small squares : 6 babies

210 small squares : ??

No. of babies = $\frac{210 \times 6}{30}$ = 42 babies

42 babies

(Total for Question 20 is 3 marks)

21 (a) Show that $\sqrt{45} + \sqrt{20} = 5\sqrt{5}$
Show your working clearly.

$\sqrt{5\times9} + \sqrt{4\times5}$

$= 3\sqrt{5} + 2\sqrt{5}$

$= 5\sqrt{5}$

(2)

(b) Express $\dfrac{2}{\sqrt{3}-1}$ in the form $p + \sqrt{q}$
where p and q are integers.
Show your working clearly.

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

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

$\sqrt{3}+1$

(2)

(c) Express $x^2 + 6\sqrt{2}x - 1$ in the form $(x + a)^2 + b$
Show your working clearly.

$x^2 + 6\sqrt{2}x - 1 = (x+3\sqrt{2})^2 - (3\sqrt{2})^2 - 1$

$= (x+3\sqrt{2})^2 - 18 - 1$

$= (x+3\sqrt{2})^2 - 19$

$(x+3\sqrt{2})^2 - 19$

(2)

(Total for Question 21 is 6 marks)

22

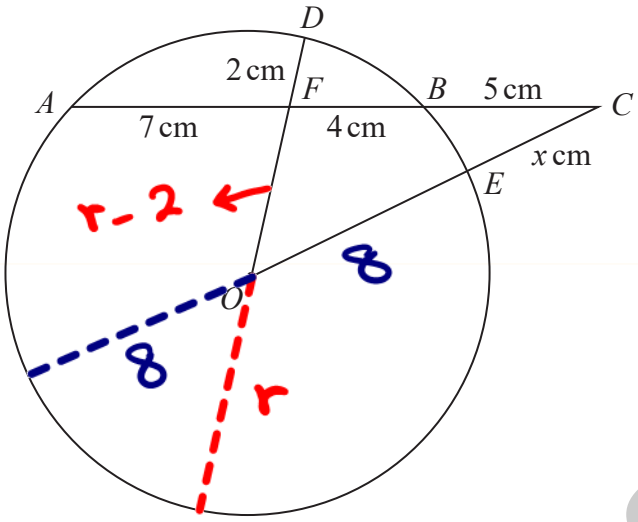


Diagram **NOT** accurately drawn

A, *D*, *B* and *E* are points on a circle, centre *O*.
AFBC, *OEC* and *OFD* are straight lines.

AF = 7 cm, *FB* = 4 cm, *BC* = 5 cm, *FD* = 2 cm and *CE* = *x* cm.

Work out the value of *x*.
Show your working clearly.

OF = r - 2

r : radius

$2(r + r - 2) = 4 \times 7$

$2(2r - 2) = 28 \quad \div 2$

$2r - 2 = 14$

$2r = 16$

$r = 8$

$5(5 + 4 + 7) = x(x + 8 + 8)$

$5 \times 16 = x(x + 16)$

$80 = x^2 + 16x$

$x^2 + 16x - 80 = 0$

$(x + 20)(x - 4) = 0$

$x = 4$ or $x = -20$

$x = 4$ only rejected

$x =$ 4

(Total for Question 22 is 6 marks)

23 The sum of the first 48 terms of an arithmetic series is 4 times the sum of the first 36 terms of the same series.

Find the sum of the first 30 terms of this series.

$S_{48} = 4 \times S_{36}$

$\frac{48}{2}(2a+(48-1)d) = 4\left(\frac{36}{2}(2a+(36-1)d\right)$

$24(2a+47d) = 4\times 18(2a+35d)$

$24(2a+47d) = 72(2a+35d)$

$2a+47d = 3(2a+35d)$

$2a+47d = 6a+105d$

$6a+105d-2a-47d = 0$

$4a+58d = 0 \quad \div 2$

$2a+29d = 0$

$S_{30} = \frac{30}{2}(2a+(30-1)d)$

$S_{30} = 15\times(2a+29d)$

$S_{30} = 15\times 0$

$S_{30} = 0$

0

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS