

GCSE Mathematics

Practice Tests: Set 9

Paper 2H (Calculator)

Time: 1 hour 30 minutes

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

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.*
- **Calculators may be used.**
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must **show all your working out.**



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.

Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 x , 10 and y are three integers written in order of size, starting with the smallest integer.

The mean of x , 10 and y is 11

The range of x , 10 and y is 7

Work out the value of x and the value of y .

<u>mean</u>	$\frac{x+y+10}{3} = 11$	
(x3)	$x+y+10 = 33$	
(-10)	$x+y = 23$ ①	
<u>Range</u>	$y-x = 7$	$x = \dots\dots\dots 8$
(+x)	$y = x+7$ ②	$y = \dots\dots\dots 15$
② in ①	$x+x+7 = 23$	
	$2x = 16$	

(Total for Question 1 is 2 marks)

- 2 A box is put on a table.

The face of the box in contact with the table is in the shape of a rectangle, 2 m by 1.25 m.

The pressure on the table due to the box is 42 newtons/m²

Work out the force exerted by the box on the table.

Pressure Formula

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Area = $l \times w$ ($l \times w$)	$A = 2\text{m} \times 1.25\text{m}$ $= 2.5\text{m}^2$
$P = 42\text{N/m}^2$	$42 = \frac{F}{2.5}$
$P = \frac{F}{A}$	
(x2.5)	$105\text{N} = F$

..... 105 newtons

(Total for Question 2 is 3 marks)

Mean from Grouped Frequency

- 3 The table gives information about the times, in hours, some students spent doing sport one week.

Time (T hours)	Frequency
$0 < T \leq 2$	5
$2 < T \leq 4$	9
$4 < T \leq 6$	24
$6 < T \leq 8$	40
$8 < T \leq 10$	7

midpoint	f_m
1	5
3	27
5	120
7	280
9	63
	$\Sigma f_m = 495$

TOTALS $\Sigma f = 85$

Calculate an estimate for the mean time these students spent doing sport.
Give your answer in hours, correct to 1 decimal place.

$$\text{Estimate for mean} = \frac{\Sigma f_m}{\Sigma f}$$

$$= \frac{495}{85}$$

$$= 5.8 \text{ hours (1 d.p.)}$$

..... 5.8 hours

(Total for Question 3 is 4 marks)

Fractions and Percentages of an amount

4 Behnaz makes candles.

She has 6.3 kilograms of wax and uses it all to make candles.
Each candle Behnaz makes uses 210 grams of wax.

Behnaz sells $\frac{2}{5}$ of the candles for £13 each.

She then reduces this price by 20% and sells the rest of the candles.

Work out the total amount of money Behnaz gets by selling all the candles she made.

Number of candles made:	$6.3 \text{ kg} = 6300 \text{ g}$	$6300 \text{ g} \div 210 \text{ g} = 30 \text{ candles}$
Number of candles for £13	$30 \times \frac{2}{5}$	$= 12 \text{ candles}$
Money generated	$£13 \times 12$	$= £156$
18 candles left		
20% decrease	$£13 - 20\%$	$= £10.40$
money generated	$£10.40 \times 18$	$= £187.20$
Total money	$£156 + £187.20$	$= \underline{\underline{£343.20}}$

£ 343.20

(Total for Question 4 is 4 marks)

Ratio and Proportion

- 5 Anna and Lionel share £675 in the ratio 4 : 5
Lionel gives $\frac{3}{5}$ of his share of the money to his mother.

How much money does Lionel give to his mother?

A : L	4 : 5
($\div 9$)	$4 + 5 = 9 \text{ parts} = \pounds 675$
4 : 5 ($\times 75$)	1 part = $\pounds 75$
Lionel = $\pounds 375$	300 : 375
	$\frac{3}{5}$ of $\pounds 375$
	= <u><u>$\pounds 225$</u></u>

£ 225

(Total for Question 5 is 3 marks)

Expanding and Simplifying

6 (a) Expand and simplify $3(c-7) + 2(3c+4)$

$$\begin{array}{l|l} \text{expand} & 3c - 21 + 6c + 8 \\ \text{collect} & 9c - 13 \end{array}$$

$$\underline{\hspace{10em} 9c - 13 \hspace{10em}}$$

(2)

(b) Expand and simplify $(x+7)(x-2)$

Expanding brackets

$$\begin{array}{l|l} \text{Expand} & (x+7)(x-2) \\ & = x^2 - 2x + 7x - 14 \\ \text{collect} & = \underline{\underline{x^2 + 5x - 14}} \end{array}$$

$$\underline{\hspace{10em} x^2 + 5x - 14 \hspace{10em}}$$

(2)

(c) Factorise fully $28y^2 - 21y$

Factorising

Both 7 and y are factors
 $= 7y(4y-3)$

$$\underline{\hspace{10em} 7y(4y-3) \hspace{10em}}$$

(2)

(Total for Question 6 is 6 marks)

Solving Equations

7 Solve $\frac{7x-2}{4} = 3x+1$

Show clear algebraic working.

$$\begin{array}{l|l} & \frac{7x-2}{4} = 3x+1 \\ (x4) & 7x-2 = 4(3x+1) \\ \text{expand} & 7x-2 = 12x+4 \\ (-7x) & -2 = 5x+4 \\ (-4) & -6 = 5x \\ (\div 5) & -\frac{6}{5} = x \end{array}$$

$$x = \underline{\hspace{10em} -1.2 \hspace{10em}}$$

(Total for Question 7 is 3 marks)



8 Abelle flew by plane from Dubai to Rome.

The flight time was 6 hours 42 minutes.

The average speed of the plane was 650 kilometres per hour.

Work out the distance the plane flew.

Time	6 hours 42 mins = 6.7 hours
Speed	650 km/h
Distance	$D = S \times T$ $= 650 \text{ km/h} \times 6.7 \text{ h}$ $= \underline{\underline{4355 \text{ km}}}$

.....4355.....kilometres

(Total for Question 8 is 3 marks)

9 Hiran invests 20 000 rupees in an account for 3 years at 1.5% per year compound interest.

Work out the total amount of money in the account at the end of 3 years.

Give your answer to the nearest rupee.


Compound Interest

Start \times multiplier ^t = End	$20000 \times 1.015^3 = 20913.5675$
multiplier = $1 + 1.5\% = 1.015$	
Nearest rupee	$= 20914 \text{ rupees}$

.....20914.....rupees

(Total for Question 9 is 3 marks)

SOHCAHTOA / Pythagoras
from Bearings



- 10 From point A , Stanley walks 200 m due east to point B .
From B , he then walks 160 m due south to point C .

Work out the length of AC .

Give your answer correct to 3 significant figures.

Pythagoras

$$a^2 + b^2 = c^2$$

$$160^2 + 200^2 = c^2$$

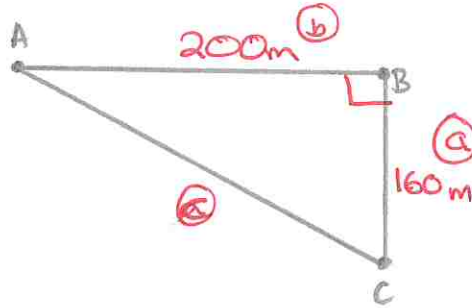
$$65600 = c^2$$

$\sqrt{\text{ANS}}$

$$256.12... = c$$

(3s.f)

$$256 = c$$



.....metres

(Total for Question 10 is 3 marks)

Volume of water in a prism tank

11 Here is an empty pool in the shape of a cuboid.

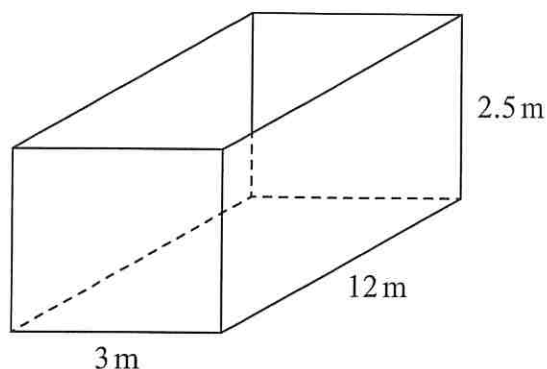


Diagram NOT accurately drawn

The width of the pool is 3 m.
 The length of the pool is 12 m.
 The top of the pool is 2.5 m above the base of the pool.

Jeb is going to put water in the pool.
 The level of the surface of the water will be 60 cm below the top of the pool.

Water flows into the pool at 400 litres per minute.
 $1 \text{ m}^3 = 1000 \text{ litres}$

How long will it take to fill the pool to 60 cm below the top of the pool?
 Give your answer in hours and minutes.

Volume needed
 $0.6 \text{ m} = 60 \text{ cm}$

$$= 3 \text{ m} \times 12 \text{ m} \times (2.5 \text{ m} - 0.6 \text{ m})$$

$$= 3 \text{ m} \times 12 \text{ m} \times 1.9 \text{ m}$$

$$= 68.4 \text{ m}^3$$

$1 \text{ m}^3 = 1000 \text{ litres}$

$$68.4 \text{ m}^3 \times 1000 = 68400 \text{ litres}$$

Time Needed

$$\frac{68400 \text{ L}}{400 \text{ L/minute}} = 171 \text{ minutes}$$

Hours and minutes

2 hours and 51 minutes

..... 2 hours 51 minutes

(Total for Question 11 is 4 marks)

Angles in Polygons

12

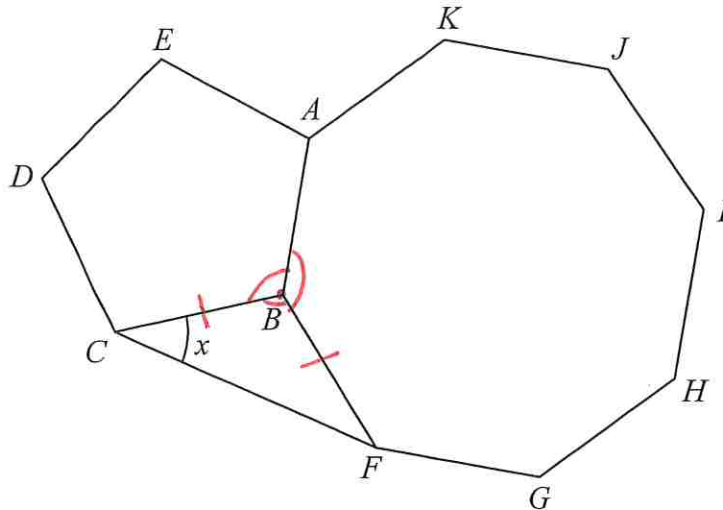


Diagram **NOT** accurately drawn

The diagram shows a regular pentagon, $ABCDE$, a regular octagon, $ABFGHIJK$, and an isosceles triangle, BCF .

Work out the size of angle x .

$$\hat{A}BC = 108^\circ$$

$$\hat{A}BF = 135^\circ$$

$$\hat{C}BF = 360^\circ - 108^\circ - 135^\circ = 117^\circ$$

$$\hat{B}CF + \hat{B}FC = 63^\circ$$

$$\hat{B}CF = \hat{B}FC$$

$$63 \div 2 = \underline{\underline{31.5}} = x$$

Interior angle of pentagon = $\frac{540}{5} = 108^\circ$ ← 3×180

Interior angle of octagon = $\frac{1080}{8} = 135^\circ$ ← 6×180

* Both the above use the fact that the sum of interior angles of n -sided polygon = $(n-2) \times 180$. *

Angles around a point = 360°

Angles in a triangle = 180°

Isosceles triangle

31.5°

(Total for Question 12 is 4 marks)

13 $ABCD$ is a trapezium.

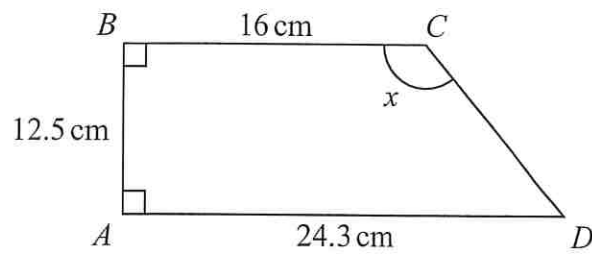
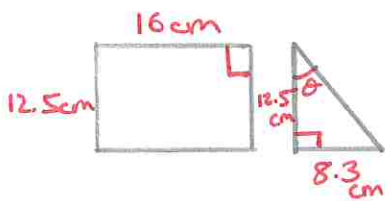


Diagram **NOT** accurately drawn

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

Two shapes



Shift tan

$$x = 90^\circ + \theta$$

SOLICANTO A

$$\tan \theta = \frac{8.3}{12.5}$$

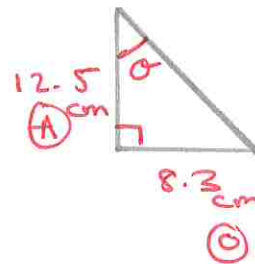
$$\tan \theta = \frac{8.3}{12.5}$$

$$\theta = 33.58416049$$

$$\theta \approx 33.6^\circ$$

$$x = 90^\circ + 33.6^\circ$$

$$= 123.6^\circ \text{ (1 d.p.)}$$



..... 123.6

(Total for Question 13 is 4 marks)

- 14 Change a speed of 72 kilometres per hour to a speed in metres per second.

$$\begin{array}{l}
 \text{metres (x1000)} \\
 \text{1 hour} = 60 \text{ mins} = 3600 \text{ secs} \\
 \text{Seconds... } (\div 3600)
 \end{array}
 \left|
 \begin{array}{l}
 \frac{72 \text{ km}}{1 \text{ hour}} \\
 = \frac{72000 \text{ m}}{1 \text{ hour}} \\
 = \frac{72000 \text{ m}}{3600 \text{ seconds}} \\
 = 20 \text{ m/second}
 \end{array}
 \right.$$

..... ²⁰ metres per second

(Total for Question 14 is 3 marks)

Percentage Change

15 A company makes cars.

In 2016, the company made 350 cars.

In the first 6 months of 2017, the company made 25 cars each month.

In the last 6 months of 2017, the company made 45 cars each month.

(a) Work out the percentage increase in the number of cars the company made from 2016 to 2017.

cars made Jan-June (first 6 months)	$6 \times 25 = 150$
cars made July-Dec (last 6 months)	$6 \times 45 = 270$
Total cars	$150 + 270 = 420$
$\% \text{ change} = \frac{\text{change}}{\text{original}} \times 100$	$\frac{70}{350} \times 100 = 20\%$

..... 20 %
(4)

The company's income in 2017 was £500 000 more than the company's income in 2016.

The company's income in 2017 was 8% more than the company's income in 2016.

(b) Work out the company's income in 2016.

Income as money = Increase as %	$£500000 = 8\%$
(÷ 8)	$£62500 = 1\%$
(× 100)	$£6,250,000 = 100\%$

£ 6,250,000
(3)

(Total for Question 15 is 7 marks)

- 16 The straight line L_1 has equation $y = 6 - 2x$
 The straight line L_2 is perpendicular to L_1 and passes through the point $(4, 7)$
 Find the coordinates of the point where the line L_2 crosses the x -axis.

L_1 gradient
 $(y = mx + c)$

$m = -2$

$m_1 \times m_2 = -1$

L_2 gradient = $\frac{1}{2}$

$y = \frac{1}{2}x + c$
 at $(4, 7)$

$7 = \frac{1}{2}(4) + c$

$7 = 2 + c$

(-2)

$5 = c$

Equation of L_2 :

$y = \frac{1}{2}x + 5$

L_2 on x -axis: $(y = 0)$

$0 = \frac{1}{2}x + 5$

(-5)

$-5 = \frac{1}{2}x$

$(x2)$

$-10 = x$

$(\dots -10 \dots, \dots 0 \dots)$

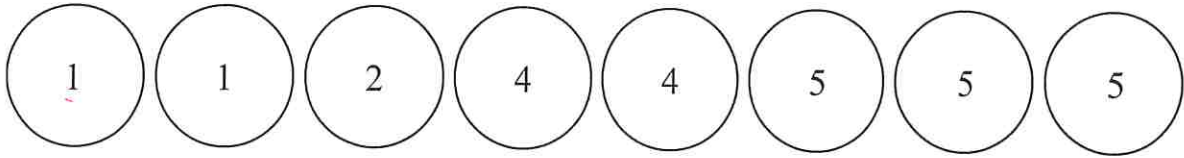
(Total for Question 16 is 4 marks)

$y = \frac{1}{2}x + 5$ at $(-10, 0)$

Dependent Events Probability

$$\text{odd} = \frac{5}{8} \quad \text{even} = \frac{3}{8}$$

- 17 There are 8 counters in a bag.
There is a number on each counter.



Fiona takes at random **three** of the counters.
She adds the numbers on the **three** counters to get her total.

Work out the probability that her total is an odd number.

Logic: odd can be made by the following combinations:

$$(\text{Odd}, \text{odd}, \text{odd}) \quad P(O, O, O) = \left(\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}\right) = \frac{60}{336}$$

$$(\text{odd}, \text{even}, \text{even}) \quad P(O, E, E) = \left(\frac{5}{8} \times \frac{3}{7} \times \frac{2}{6}\right) = \frac{30}{336}$$

$$(\text{even}, \text{odd}, \text{even}) \quad P(E, O, E) = \left(\frac{3}{8} \times \frac{5}{7} \times \frac{2}{6}\right) = \frac{30}{336}$$

$$(\text{even}, \text{even}, \text{odd}) \quad P(E, E, O) = \left(\frac{3}{8} \times \frac{2}{7} \times \frac{5}{6}\right) = \frac{30}{336}$$

$$\text{Total probability} = \frac{60}{336} + \frac{30}{336} + \frac{30}{336} + \frac{30}{336}$$

$$= \frac{150}{336}$$

$$\frac{150}{336}$$

.....
(Total for Question 17 is 4 marks)

Bounds

18 $a = \frac{p-q}{t}$

$p = 8.4$ correct to 2 significant figures.

$q = 6.3$ correct to 2 significant figures.

$t = 0.27$ correct to 2 significant figures.

Work out the upper bound for the value of a .

Show your working clearly.

Give your answer correct to 1 decimal place.

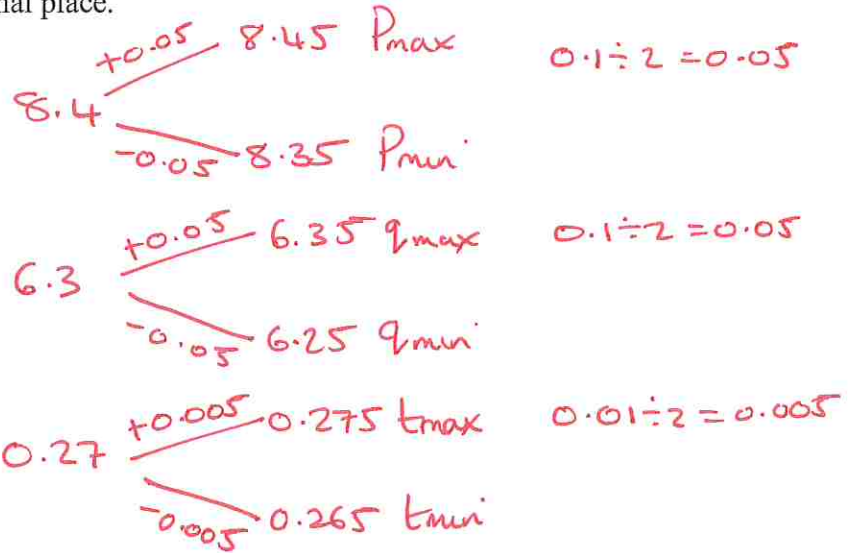
P Error

q Error

t Error

$$a = \frac{p-q}{t}$$

$$\therefore a_{\max} = \frac{p_{\max} - q_{\min}}{t_{\min}}$$



* Numerator is maximised by $P_{\max} - q_{\min}$ *

$$a_{\max} = \frac{8.45 - 6.25}{0.265}$$

$$= \underline{\underline{8.3}} \text{ (1 d.p.)}$$

8.3

(Total for Question 18 is 3 marks)

19 Solve the inequality $4x^2 - 5x - 6 > 0$

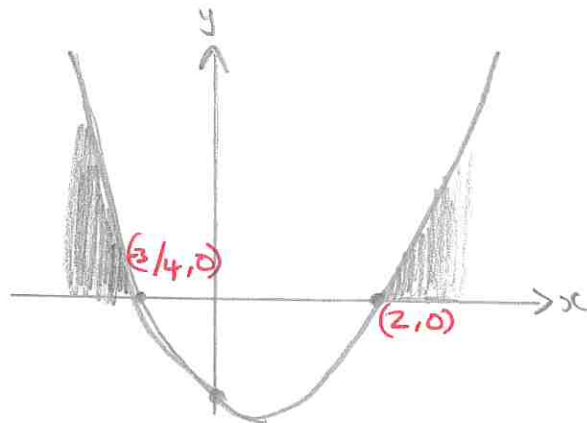
SOLVE EQUATION $(4x + 3)(x - 2) = 0$

$4x + 3 = 0$ OR $x - 2 = 0$

(-3) $4x = -3$

(÷4) $x = -\frac{3}{4}$ OR $x = 2$

Sketch



$4x^2 - 5x - 6 > 0$

Where is the function greater than 0?

Conclusion

$x > 2$ and $x < -\frac{3}{4}$

$x > 2, x < -\frac{3}{4}$

(Total for Question 19 is 4 marks)



20 A 3-D shape consists of a hollow sphere made of metal.



The diagram shows a cross section drawn through the centre, O , of the sphere.

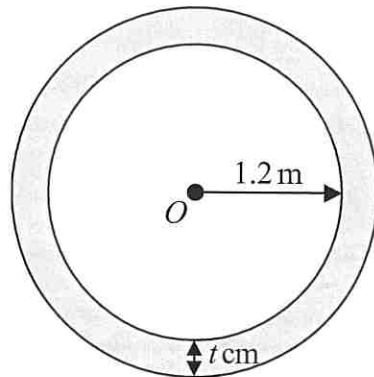


Diagram NOT accurately drawn

$m = 1980 \text{ kg}$

$D = 2700 \text{ kg/m}^3$

$V = ?$

The internal radius of the sphere is 1.2 m.
The thickness of the metal is t cm.

The density of the metal is 2700 kg per m^3

The mass of the 3-D shape is 1980 kg.

Work out the value of t .

Give your answer correct to 2 significant figures.

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

<p>Volume of actual ball has radius 1.2</p> <p>\therefore volume of metal piece:</p> <p>$m = D \times V$</p> <p>($\div 2700$)</p> <p>($+ \frac{4}{3}\pi(1.2)^3$)</p> <p>($\times 3$)</p> <p>($\div 4\pi$)</p> <p>$\sqrt[3]{ANS}$</p> <p>($- 1.2$)</p> <p>$m \rightarrow \text{cm}$ ($\times 100$)</p>	<p>Density same all the way through</p> <p>Ball has a mass of 1980 kg</p> <p>$= \frac{4}{3}\pi(1.2+t)^3 - \frac{4}{3}\pi(1.2)^3$</p> <p>$1980 = 2700 \times [\frac{4}{3}\pi(1.2+t)^3 - \frac{4}{3}\pi(1.2)^3]$</p> <p>$\frac{1980}{2700} = \frac{4}{3}\pi(1.2+t)^3 - \frac{4}{3}\pi(1.2)^3$</p> <p>$\frac{1980}{2700} + \frac{4}{3}\pi(1.2)^3 = \frac{4}{3}\pi(1.2+t)^3$</p> <p>$7.97156\dots m = \frac{4}{3}\pi(1.2+t)^3$</p> <p>$23.9\dots m = 4\pi(1.2+t)^3$</p> <p>$1.903\dots m = (1.2+t)^3$</p> <p>$1.239\dots m = 1.2+t = \dots\dots\dots 3.9 \text{ cm}$</p> <p>$0.039\dots m = t$ (Total for Question 20 is 5 marks)</p> <hr/> <p>3.9 cm (2 s.f) = t</p>
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21 Express $\frac{4x^2-25}{5x^2+2x-7} \times \left(\frac{2}{x-3} - \frac{3}{2x-5} \right)$ as a single fraction in its simplest form.

combine

cross multiply

$$\frac{2}{x-3} - \frac{3}{2x-5}$$

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

$$= \frac{4x-10-3x+9}{(x-3)(2x-5)}$$

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

factorise $\frac{4x^2-25}{5x^2+2x-7}$

$$= \frac{(2x+5)(2x-5)}{(5x+7)(x-1)} = \frac{(2x+5)(2x-5)}{(5x+7)(x-1)}$$

Simplify (x)

$$\frac{(2x+5)(2x-5)}{(5x+7)(x-1)} \times \frac{(x-1)}{(x-3)(2x-5)}$$

Simplify (cancel)

$$= \frac{(2x+5)(2x-5)(x-1)}{(5x+7)(x-1)(x-3)(2x-5)}$$

$$= \frac{2x+5}{(5x+7)(x-3)}$$

$$\frac{2x+5}{(5x+7)(x-3)}$$

(Total for Question 21 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS