

GCSE Mathematics

Practice Tests: Set 6

Paper 3H (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

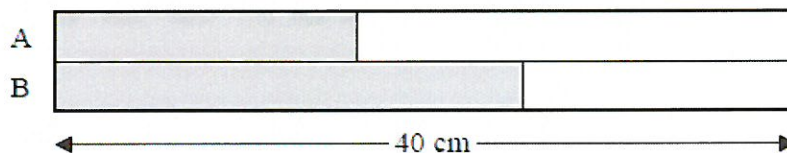
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. Here is a rectangle.



The rectangle has been divided into two strips, A and B.
The strips have the same width.

$\frac{2}{5}$ of strip A is shaded. $\frac{3}{5} \times 40 = 24$

$\frac{5}{8}$ of strip B is shaded. $\frac{3}{8} \times 40 = \frac{15}{39}$

The length of the rectangle is 40 cm.

What fraction of the rectangle is **not** shaded?

$$\frac{39}{80}$$

.....
(Total 4 marks)

2. Make w the subject of the formula $P = \frac{w-3}{2}$

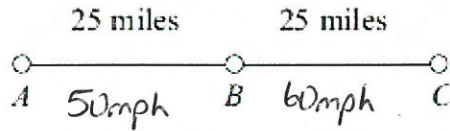
$$2P = w - 3$$

$$2P + 3 = w$$

$$w = 2P + 3$$

.....
(Total 2 marks)

3.



A , B and C are 3 service stations on a motorway.

$$AB = 25 \text{ miles}$$

$$BC = 25 \text{ miles}$$

Aysha drives along the motorway from A to C .

Aysha drives at an average speed of 50 mph from A to B .

She drives at an average speed of 60 mph from B to C .

Work out the difference in the time Aysha takes to drive from A to B and the time Aysha takes to drive from B to C .

Give your answer in minutes.

$$AB : \text{TIME} = \frac{25}{50} = \frac{1}{2} \text{ HOUR} = 30 \text{ MINUTES}$$

$$BC : \text{TIME} = \frac{25}{60} \text{ HOUR} = \frac{25}{60} \times 60 = 25 \text{ MINUTES}$$

$$\text{DIFFERENCE} = 30 - 25 = 5 \text{ MINUTES}$$

..... 5 minutes

(Total 3 marks)

4. Solve the simultaneous equations

$$4x + 3y = -7 \quad \times 4$$

$$3x - 4y = 26 \quad \times 3$$

$$16x + 12y = -28$$

$$9x - 12y = 78$$

$$\therefore 25x = 50$$

$$\therefore x = 2$$

$$3 \times 2 - 4y = 26$$

$$\therefore -4y = 20$$

$$\therefore y = -5$$

$$x = \dots 2 \dots$$

$$y = \dots -5 \dots$$

(Total 4 marks)

5. Toby invested £4500 for 2 years in a savings account.
He was paid 4% per annum compound interest.

(a) How much did Toby have in his savings account after 2 years?

$$4500 \times 1.04^2$$

$$\pounds \underline{4867.20} \dots$$

(3)

Jaspir invested £2400 for n years in a savings account.
He was paid 7.5% per annum compound interest.

At the end of the n years he had £3445.51 in the savings account.

(b) Work out the value of n .

$$2400 \times 1.075^n = 3445.51$$

$$\therefore 1.075^n = \frac{3445.51}{2400} = 1.435629167$$

$$n = 4 \quad 1.074^n = 1.3305$$

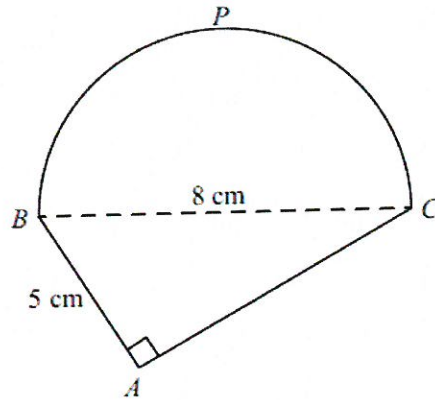
$$n = 5 \quad 1.074^n = 1.42896$$

$$\underline{5} \dots$$

(2)

(Total 5 marks)

6. Here is a shape.



BPC is a semicircle.
 BAC is a right-angled triangle.

$BC = 8$ cm.
 $AB = 5$ cm.

Work out the perimeter of the shape.
 Give your answer correct to 3 significant figures.

$$\text{PERIMETER OF SHAPE} = \text{LENGTH OF ARC } BPC \\ + AB + AC$$

$$\text{ARC } BPC = \frac{1}{2} \pi \times 8 = 4\pi = 12.566$$

$$AC^2 = 8^2 - 5^2 = 64 - 25 = 39$$

$$\therefore AC = \sqrt{39} = 6.245$$

$$12.566 + 6.245 = \cancel{18.811} + 5 = 23.811$$

..... 23.8 ~~18.8~~ cm

(Total 5 marks)

7. The diagram shows a trapezium.

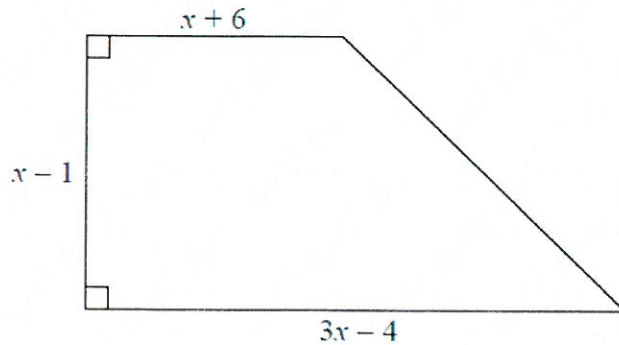


Diagram **NOT**
accurately drawn

All measurements on the diagram are in centimetres.

The area of the trapezium is 119 cm^2

- (i) Show that $2x^2 - x - 120 = 0$

$$\begin{aligned}
 \text{AREA} &= \frac{x-1}{2} (x+6 + 3x-4) = \frac{x-1}{2} (4x+2) \\
 &= (x-1)(2x+1) \\
 &= 2x^2 + x - 2x - 1 \\
 &= 2x^2 - x - 1 = 119 \\
 \therefore 2x^2 - x - 120 &= 0.
 \end{aligned}$$

- (ii) Find the value of x .

Show your working clearly.

$$a = 2 \quad b = -1 \quad c = -120$$

$$x = \frac{1 \pm \sqrt{1^2 + 4 \times 2 \times 120}}{4}$$

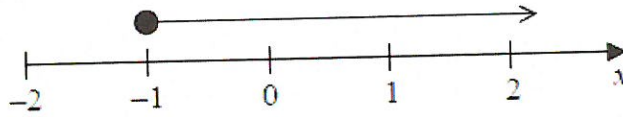
$$= \frac{1 \pm \sqrt{961}}{4}$$

$$= \frac{1 \pm 31}{4} = 8, -\frac{15}{2}$$

$$x = 8$$

(Total 6 marks)

8. Here is a number line.



(a) Write down the inequality shown on the number line.

$$\underline{\hspace{10em} x \geq -1 \hspace{10em}} \quad (1)$$

p is an integer.

$$-5 < p \leq -2$$

(b) Write down all the possible values of p .

$$\underline{\hspace{10em} -4, -3, -2 \hspace{10em}} \quad (2)$$

(c) Solve $5y - 2 < 18$

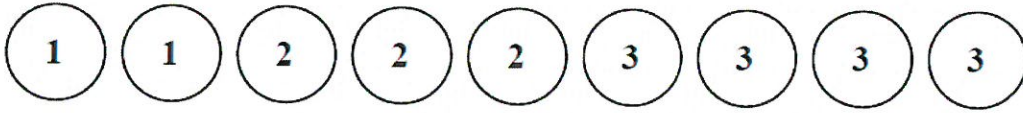
$$5y < 20$$

$$y < 4$$

$$\underline{\hspace{10em} y < 4 \hspace{10em}} \quad (2)$$

(Total 5 marks)

9. There are 9 counters in a bag.
There is a number on each counter.



Kal takes at random 3 counters from the bag.

He adds together the numbers on the 3 counters to get his Total.

Work out the probability that his Total is 6.

POSSIBILITIES: 1, 2, 3 $6 \times \frac{2}{9} \times \frac{3}{8} \times \frac{4}{7} = \frac{144}{504}$
 2, 2, 2 $\frac{3}{9} \times \frac{2}{8} \times \frac{1}{7} = \frac{6}{504}$

$$\frac{144}{504} + \frac{6}{504} = \frac{150}{504}$$

(NOTE: 1, 2, 3 CAN BE CHOSEN 6 WAYS
 ie 1, 2, 3 1, 3, 2 2, 1, 3 2, 3, 1 3, 1, 2 3, 2, 1)

$$\frac{150}{504}$$

(Total 5 marks)

10. The highest common factor (HCF) of 140 and x is 20. $\therefore x$ IS A MULTIPLE OF 20 ^①
 The lowest common multiple (LCM) of 140 and x is 420. $\therefore x$ IS A FACTOR OF 420 ^②

Find the value of x .

x CAN BE 20, 40, 60, 80, 100, 120 FROM ①

BUT ONLY THESE ARE ② AS WELL: 20, 40, 60

BUT LCM OF 140 AND 20 IS 140

LCM OF 140 AND 40 IS 280

$$x = \underline{\quad 60 \quad}$$

(Total 2 marks)

11. A number is decreased by 15%.
 The result is 323

What was the original number?

$$0.85 \times \text{ORIGINAL NUMBER} = 323$$

$$\therefore \text{ORIGINAL NUMBER} = \frac{323}{0.85}$$

$$\underline{\quad 380 \quad}$$

(Total 3 marks)

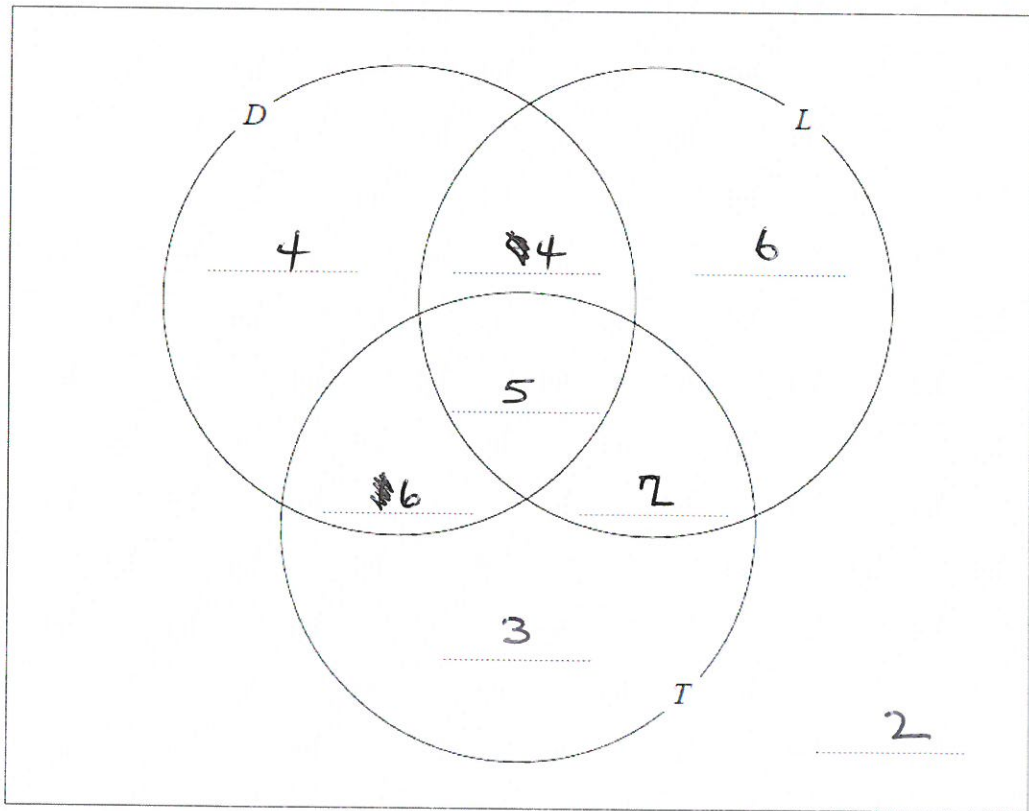
12. Each student in a group of 32 students was asked the following question.

“Do you have a desktop computer (D), a laptop (L) or a tablet (T)?”

Their answers showed that

- 19 students have a desktop computer
- 17 students have a laptop
- 16 students have a tablet
- 9 students have both a desktop computer and a laptop
- 11 students have both a desktop computer and a tablet
- 7 students have both a laptop and a tablet
- 5 students have all three.

(a) Using this information, complete the Venn diagram to show the number of students in each appropriate subset.



(3)

One of the students with both a desktop computer and a laptop is chosen at random.

(b) Find the probability that this student also has a tablet.

$\frac{5}{9}$

(1)

(Total 4 marks)

13. The function f is defined as

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

(a) Find $f(8)$.

$$\frac{8-6}{2} = \frac{2}{2}$$

$$\frac{1}{\dots\dots\dots}$$

(1)

(b) Express the inverse function f^{-1} in the form $f^{-1}(x) = \dots$

$$y = \frac{x-6}{2}$$

$$\therefore 2y = x-6$$

$$\therefore x = 2y+6$$

$$f^{-1}(x) = \frac{2x+6}{\dots\dots\dots}$$

(2)

The function g is defined as

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

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

$$gf(x) = \sqrt{\frac{x-6}{2} - 4}$$

$$= \sqrt{\frac{x-6-8}{2}}$$

$$= \sqrt{\frac{x-14}{2}}$$

$$gf(x) = \sqrt{\frac{x-14}{2}}$$

(2)

(Total 5 marks)

14. The diagram shows a prism.

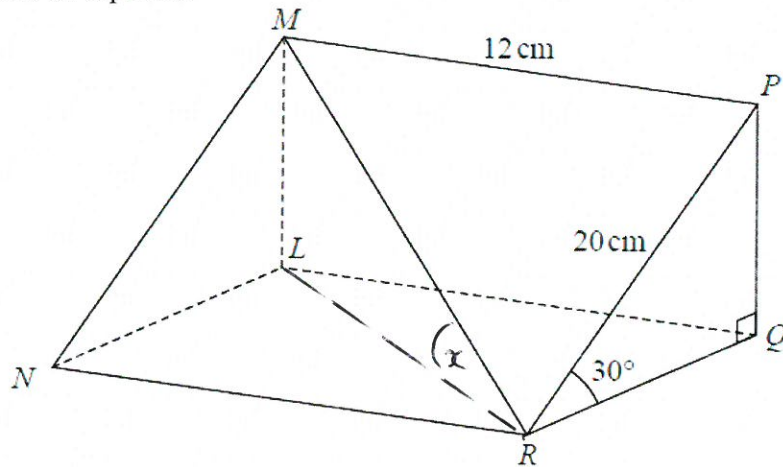


Diagram NOT accurately drawn

Triangle PQR is a cross section of the prism.

$$PR = 20 \text{ cm}$$

$$MP = 12 \text{ cm}$$

$$\text{Angle } PRQ = 30^\circ$$

$$\text{Angle } PQR = 90^\circ$$

Calculate the size of the angle that the line MR makes with the plane $RQLN$.
Give your answer correct to 1 decimal place.

$$\sin 30 = \frac{PQ}{20} \quad \therefore PQ = 20 \sin 30 = 10$$

$$\therefore ML = 10$$

$$MR^2 = 12^2 + 20^2 = 144 + 400 = 544$$

$$\therefore MR = \sqrt{544}$$

$$\therefore \sin \alpha = \frac{ML}{MR} = \frac{10}{\sqrt{544}}$$

$$\therefore \alpha = \sin^{-1} \left(\frac{10}{\sqrt{544}} \right)$$

$$\dots\dots\dots 25.4 \dots\dots\dots^\circ$$

$$(25.38 - 25.5) \quad (\text{Total 5 marks})$$

15. A scientist is studying some rabbits.
The rabbits have a disease that kills the rabbits.

A population of 160 of these rabbits was reduced to 90 rabbits in two days.
The rabbit population is decreasing exponentially.

Work out how many of the 160 rabbits will still be alive at the end of 7 days.

$$\begin{aligned} \text{LET POPULATION} &= y \\ \text{DAYS} &= x \end{aligned}$$

$$\therefore y = ka^x \quad \text{WHERE } k \text{ AND } a \text{ ARE CONSTANTS}$$

$$\text{AT } x=0, y=160 \quad \therefore 160 = ka^0 = k$$

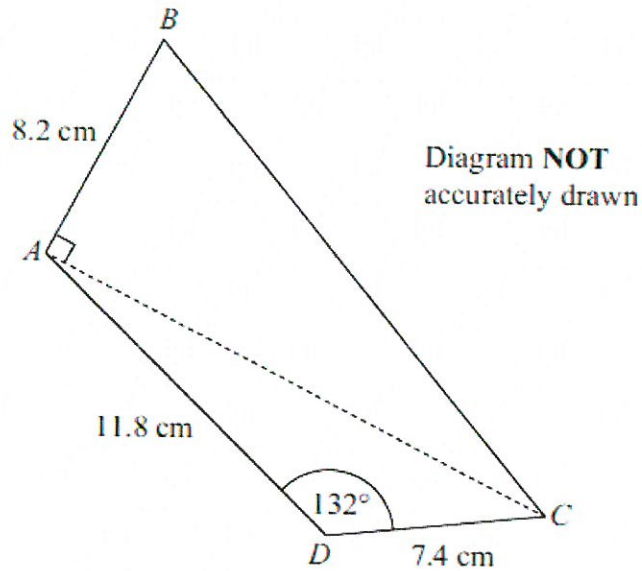
$$\text{AT } x=2, y=90 \quad \therefore 90 = 160 \times a^2$$

$$\therefore a^2 = \frac{90}{160} \quad \therefore a = \frac{3}{4}$$

$$\text{AT } x=7, y = 160 \times \left(\frac{3}{4}\right)^7 = 21.4$$

..... 21
(or 22) (Total 5 marks)

16.



Work out the area of the quadrilateral $ABCD$.
Give your answer correct to 3 significant figures.

$$\text{AREA OF TRIANGLE ADC} = \frac{1}{2} \times 11.8 \times 7.4 \times \sin 132 = 32.446$$

$$\begin{aligned} AC^2 &= 11.8^2 + 7.4^2 - 2 \times 11.8 \times 7.4 \times \cos 132 \\ &= 194 - 174.64 \cos 132 \\ &= 310.857 \end{aligned}$$

$$\therefore AC = \sqrt{310.857} = 17.631$$

$$\therefore \text{AREA OF TRIANGLE ABC} = \frac{1}{2} \times 17.631 \times 8.2 = 72.288$$

$$\therefore \text{TOTAL AREA} = 32.446 + 72.288 = 104.734$$

..... 105 cm^2

(Total 6 marks)

17. $y = at^2 - 2at$

$$x = 2a\sqrt{t}$$

Express y in terms of x and a .

Give your answer in the form $y = \frac{x^p}{ma^3} - \frac{x^q}{na}$, where p, q, m and n are integers.

$$x = 2a\sqrt{t} \quad \therefore x^2 = 4a^2t \quad \therefore t = \frac{x^2}{4a^2}$$

$$\therefore t^2 = \frac{x^4}{16a^4}$$

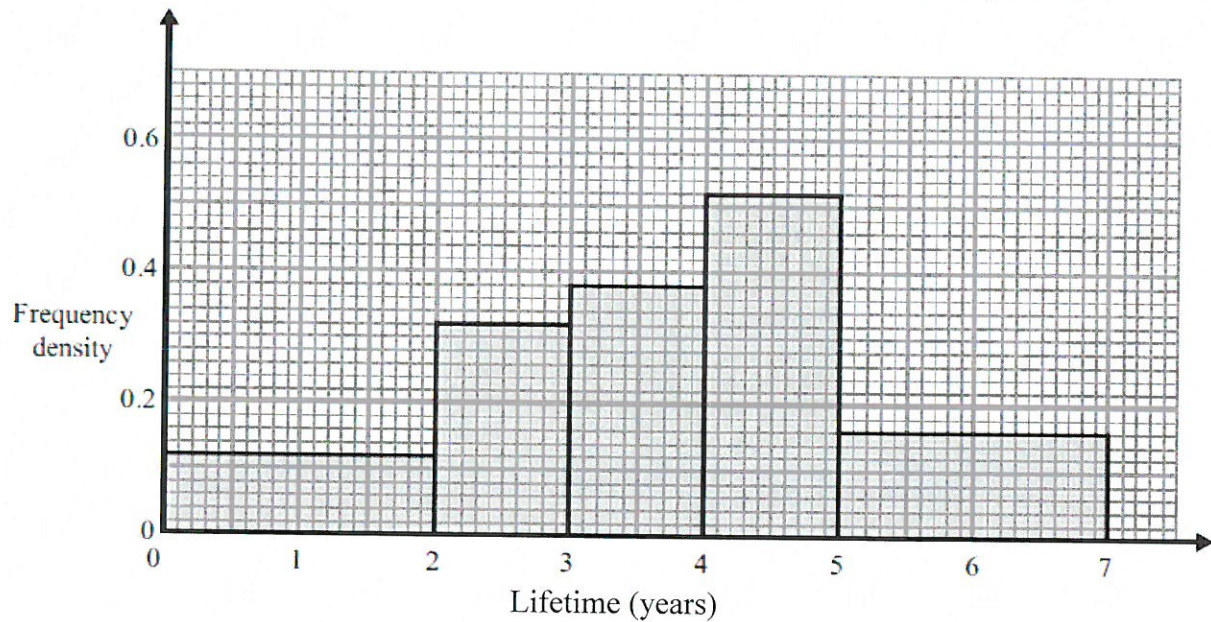
$$\therefore y = \frac{ax^4}{16a^4} - \frac{2ax^2}{4a^2}$$

$$\therefore y = \frac{x^4}{16a^3} - \frac{x^2}{2a}$$

$$y = \frac{x^4}{16a^3} - \frac{x^2}{2a}$$

(Total 4 marks)

18. The histogram shows information about the lifetime of some electrical components.



Work out the proportion of the components with a lifetime of between 1 and 6 years.

$$\begin{aligned} \text{TOTAL FREQUENCY} &= 0.12 \times 2 + 0.32 \times 1 + 0.38 \times 1 + 0.52 \times 1 \\ &\quad + 0.16 \times 2 \\ &= 1.78 \end{aligned}$$

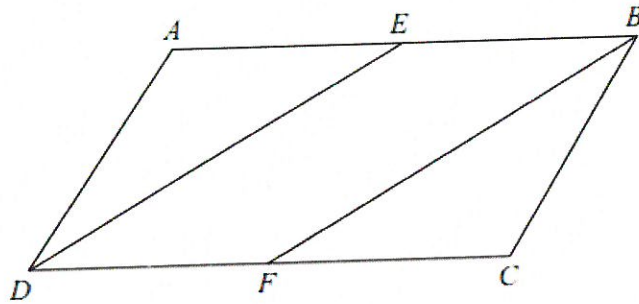
$$\begin{aligned} \text{FREQUENCY BETWEEN 1 AND 6 YEARS} &= 1.78 - 0.12 \times 1 - 0.16 \times 1 \\ &= 1.5 \end{aligned}$$

$$\therefore \text{PROPORTION} = \frac{1.5}{1.78} \times 100\% =$$

84.3%

(Total 4 marks)

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 .

PARALLELOGRAM $\therefore AD = BC$ AND $AB = DC$
 \therefore SINCE E AND F ARE MIDPOINTS $AE = FC$
 ALSO OPPOSITE ANGLES ARE EQUAL $\therefore \hat{DAE} = \hat{FCB}$
 \therefore TRIANGLES ARE CONGRUENT BY SAS.

(3)

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

IF TRIANGLES ARE CONGRUENT THEN EQUIVALENT SIDES ARE EQUAL (SSS)

SINCE $AE = FC$ AND $AD = BC$
 MUST HAVE $DE = FB$.

(1)

(Total 4 marks)

TOTAL FOR PAPER IS 80 MARKS