

Answer **all** the questions.

- 1 Carol makes birthday cards.
Each card takes the same amount of time to make.

She makes 3 cards in 48 minutes.
She has an order for 80 cards.

Can she complete this order in 3 days if she works 8 hours each day? 24hrs
Show how you decide.

$$3c = 48m$$

$$1c = 16m$$

$$80c = 16 \times 80 = 1280mins \quad \checkmark$$

$$3 \times 8 \times 60 = 1440mins \quad \checkmark \checkmark$$

Yes because the task takes less than 24hrs

[5]

- 2 Use the formula $F = \frac{s}{\sqrt{tm}}$ to find the value of F when

$$s = 5.8 \times 10^6$$

$$t = 4.1 \times 10^8$$

$$m = 3.7 \times 10^{-2}$$

Give your answer in standard form, correct to 2 significant figures.

$$F = \frac{(5.8 \times 10^6)}{\sqrt{4.1 \times 10^8 \times 3.7 \times 10^{-2}}}$$

$$= 1489.1..$$

$$= 1500$$

$$1.5 \times 10^3$$

[4]

- 3 At a railway station, trains are either eastbound or westbound.
An eastbound train leaves the station every 25 minutes.
A westbound train leaves the station every 45 minutes.

An eastbound train and a westbound train both leave the station at 8 am.

When is the next time that two trains leave the station together?

25	
50	45
75	
100	90
125	
150	135
175	
200	180
225	225

$$225 \text{ mins} = 3 \text{ hrs } 45 \text{ m}$$

+ 8 am

11 45 am

[4]

- 4 Bob makes dry concrete by mixing cement, sand and stone in the ratio 1 : 2 : 3 by weight. He buys the cement, sand and stone in bags as shown in this table.

	Weight of bag (kg)	Cost per bag (£)
Cement	25	5.50
Sand	20	2.00
Stone	15	3.90

He packs the dry concrete into 30 kg bags.

$$50 \times 30 = 1500 \checkmark$$

Bob buys just enough cement, sand and stone to make 50 bags of dry concrete.

- (a) Show that Bob buys 500 kg of sand.

[3]

$$\begin{array}{ccc} C & S_a & S_t \\ 1 & 2 & 3 \end{array}$$

$$S_a = \frac{2}{6} \times 1500 = 500 \checkmark$$

- (b) Bob sells the 50 bags of dry concrete for a total of £396.

Calculate Bob's percentage profit.

$$C = \frac{1}{6} \times 1500 = 250$$

$$\frac{250}{25} \times 5.5 = \pounds 55 \checkmark$$

$$S_a = \frac{500}{20} \times 2 = \pounds 50$$

$$\pounds 300 \checkmark$$

$$S_t = \frac{3}{6} \times 1500 = 750, \quad \frac{750}{15} \times 3.9 = \pounds 195$$

$$\frac{96}{300} \times 100 =$$

$$32 \checkmark$$

(b) % [5]

5 Multiply out and simplify.

$$(4x + y)(x - 3y)$$

$4x^2$	xy	x
$-12xy$	$-3y^2$	$-3y$

$\checkmark^2 \checkmark^3$

$$4x^2 - 11xy - 3y^2 \checkmark$$

[3]

6 A bag of sweets contains only mints, sherberts and toffees.

The ratio of the number of mints to sherberts is 2 : 3.

The ratio of the number of sherberts to toffees is 7 : 5.

What fraction of the sweets are sherberts?

	M	S	T
	2	3	
$\times 7$	14	21	15
		7	5

$\times 3$

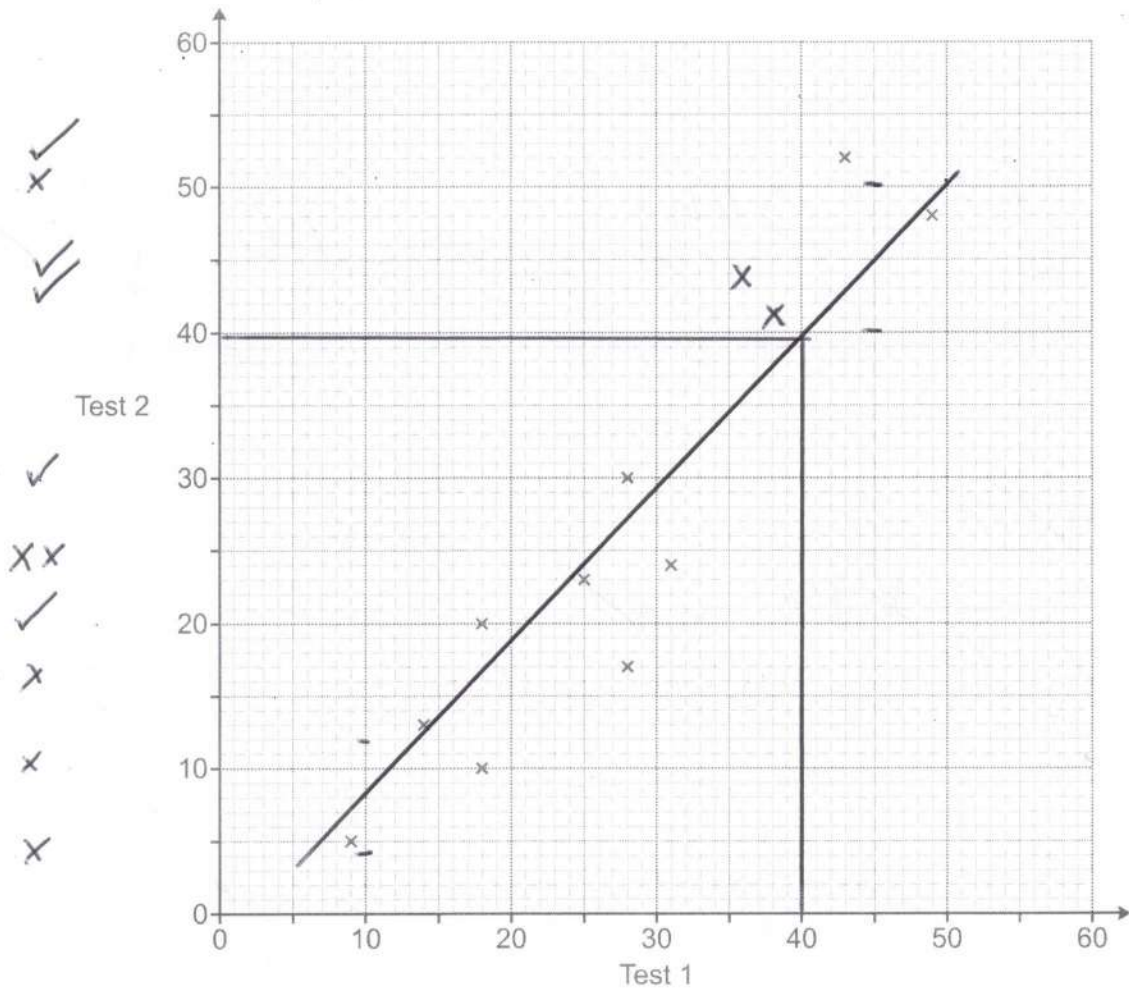
$\checkmark \checkmark$

$$\frac{21}{50}$$

$\checkmark$

[3]

- 7 12 students take two tests.
Each test is out of 60.
The scatter diagram shows the results for 10 of the students.



- (a) The table shows the results for the other 2 students.

Test 1	36	38
Test 2	44	41

x
y

Plot these results on the scatter diagram.

[1]

- (b) Describe the type of correlation shown in the scatter diagram.

(b)

positive

✓

[1]

- (c) (i) Draw a line of best fit on the scatter diagram. ✓

[1]

- (ii) Another student was absent for Test 2.
The student scored 40 marks on Test 1.

Use your line of best fit to estimate a result for this student on Test 2.

[ms 35 → 44]

(c)(ii)

40

[1]

- (d) Work out the percentage of the 12 students whose result on Test 1 is **lower** than their result on Test 2.

✓
✓ $\frac{5}{12} \times 100$ ✓

(d)

41.7

% [4]

- 8 The diagrams show the price paid by two groups of people visiting a funfair.

5 adults	£	
4 children	£	
Total £		78

3 adults	£	
6 children	£	
Total £		63

Assume each adult pays the same price and each child pays the same price.

Find the price for an adult and the price for a child.

$$5a + 4c = 78$$

(x3)

✓

$$3a + 6c = 63$$

(x2)

✓

$$\begin{array}{rcl} 15a + 12c & = & 234 \\ - 6a + 12c & = & 126 \\ \hline 9a & = & 108 \end{array}$$

✓

$$a = \frac{108}{9} = 12 \quad \checkmark$$

$$3 \times 12 + 6c = 63$$

$$6c = 27$$

$$c = \frac{27}{6}$$

Adult price = £

12

✓

Child price = £

4.50

[5]

- 9 Here is function A.



- (a) A number, k , is input into function A.
The output is also k .

Find the value of k .

$$\begin{aligned} 3(k-4) &= k \\ 3k - 12 &= k \\ 2k &= 12 \end{aligned}$$

(a) $k = 6$ [3]

- (b) The output of function A is y .

Write an algebraic expression, in terms of y , for the input of function A.

$$\leftarrow \frac{y}{3} + 4$$

(b) $\frac{y}{3} + 4$ [2]

- (c) The diagram shows a composite function with an input, n , and an output of 96.



Find the value of n .

$$\frac{96}{3} + 4 = 36$$

$$\frac{36}{3} + 4 = 16$$

(c) $n = 16$ [2]

- 10 The value of a house, £ H , is given by the formula

$$H = 165000 \times 1.03^t$$

where t is the number of years after 1st January 2010.

- (a) Write down the value of the house on 1st January 2010.

$$165000 \times 1.03^0$$

(a) £ 165000 ✓ [1]

- (b) Write down the annual percentage increase in the value of the house.

(b) 3 ✓ % [1]

- (c) Show that the value of the house is over £200 000 on 1st January 2017. [2]

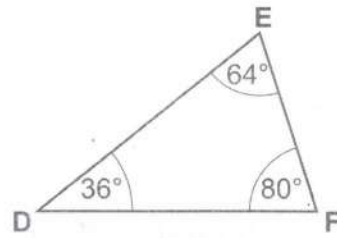
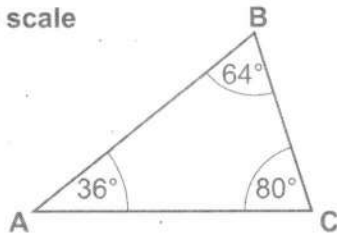
$$165000 \times 1.03^7$$

$$= 202929.1...$$

$$= 203000 \quad (>200000)$$

- 11 (a) Are these two triangles definitely congruent?
Give a reason.

Not to scale

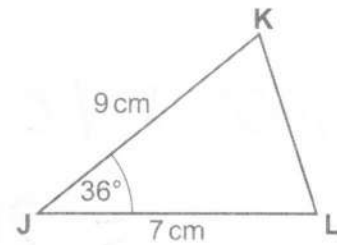
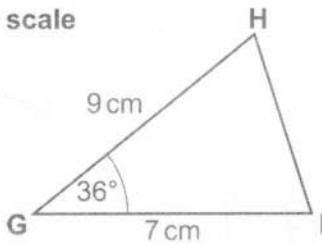


No because must know at least one length ✓

[1]

- (b) Prove that these two triangles are congruent.

Not to scale



$$GH = JK \quad \checkmark$$

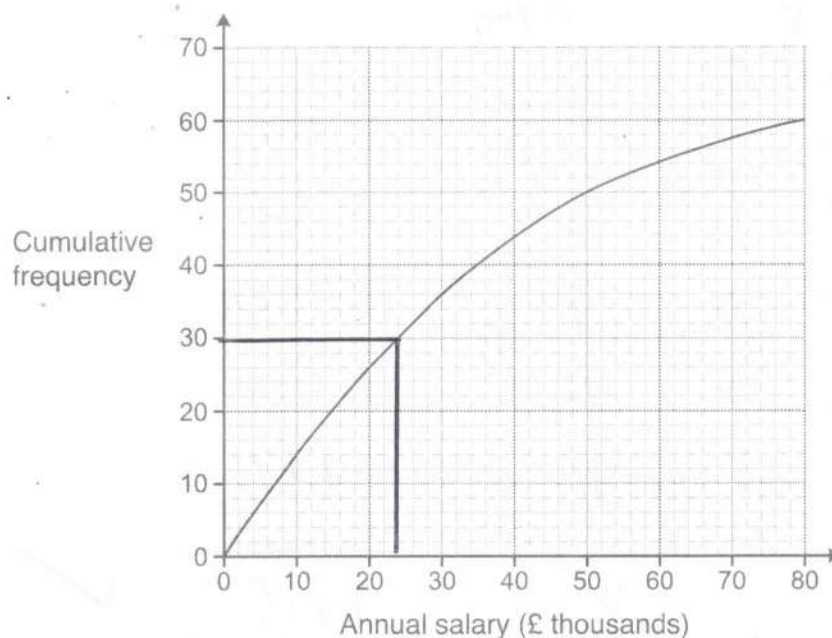
$$\angle HGI = \angle KJL$$

$$GI = JL \quad \checkmark$$

SAS hence congruent ✓

[3]

- 12 The cumulative frequency graph summarises the annual salary, p (£ thousands), of the 60 workers in a factory.



- (a) Use the graph to estimate the median annual salary.

(a) £ 24 thousands [1]

- (b) Complete this cumulative frequency table.

Annual salary, p (£ thousands)	Cumulative frequency
$p \leq 10$	14
$p \leq 20$	26
$p \leq 30$	36
$p \leq 50$	50
$p \leq 80$	60

3
✓
✓ All

[2]

- (c) Use the information in the cumulative frequency table to calculate an estimate of the mean annual salary.

mid. pts	x	freq	
5	x	14	= 70
15	x	12	= 180
25	x	10	= 250
40	x	14	= 560
65	x	10	= 650
			1710

$$1710 \div 60$$

(c) £ 28.5 thousands [5]

- (d) Explain why your estimate of the median is more reliable than your estimate of the mean.

Mean uses mid pts which are approximate.

[1]

- 13 (a) A transport lorry consists of a cab and a trailer.
The trailer has a volume of 90 m^3 .
Alfie makes a model of this lorry using a scale of 1 : 72.

Work out the volume of the trailer in Alfie's model, giving your answer in cm^3 .

$$90 \times 100^3 \div 72^3$$

$$= 241.1$$

✓✓

✓

(a) 241 cm^3 [3]

- (b) Alfie paints his model lorry.
He has eight colours available.

He decides to paint the cab in one colour and the trailer in a different colour.

He then wants to paint his name on the trailer.
The name must be in a different colour to the trailer.

In how many different ways can Alfie paint his model lorry?

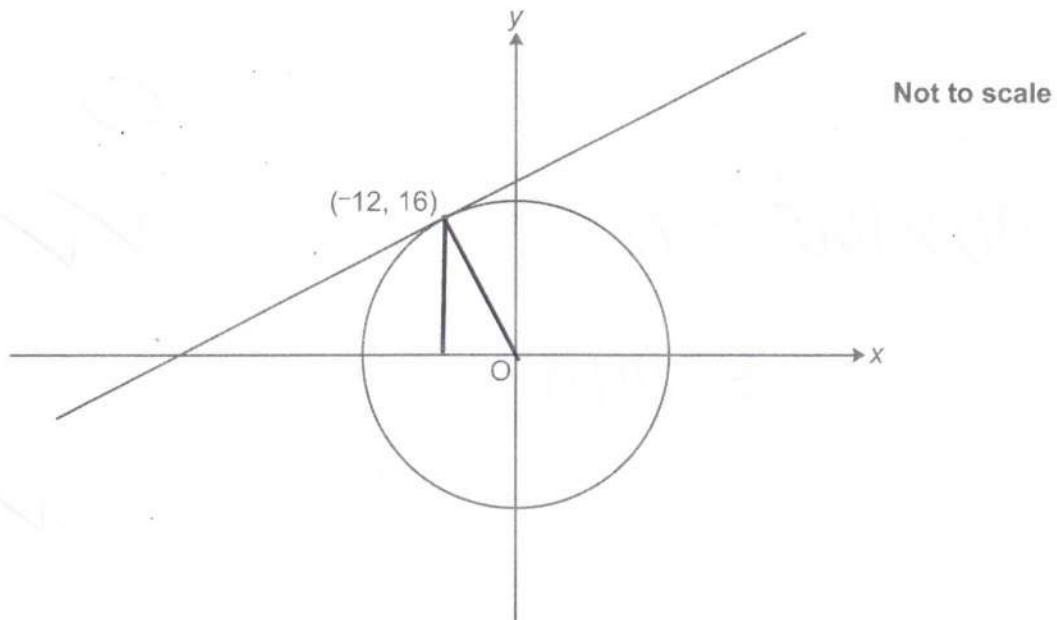
$$\begin{array}{ccc} C & T & N \\ 8 & 7 & 7 \\ \times & \times & \\ \hline \end{array}$$

✓✓

(b) 392 [3]

✓

- 14 The diagram shows a circle with centre $(0, 0)$ and a tangent at the point $(-12, 16)$.



The tangent crosses the y -axis at the point $(0, p)$.

Find the value of p .

$$m_{\text{radius}} = \frac{-16}{12} = -\frac{4}{3} \quad \checkmark$$

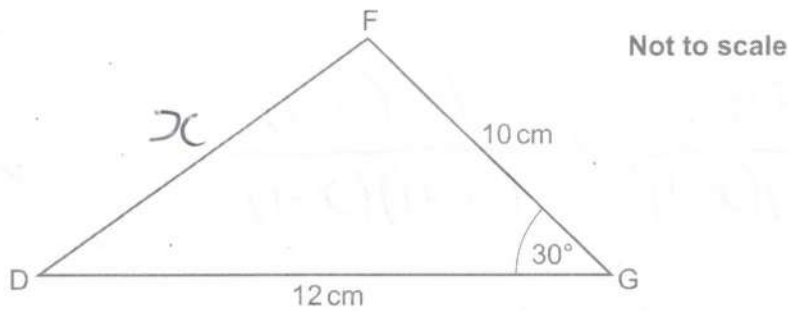
$$m_{\text{tangent}} = \frac{3}{4} \quad \checkmark$$

$$16 = \frac{3}{4}x(-12) + c \quad \checkmark \checkmark$$

$$c = 16 + 9$$

$$p = \dots\dots\dots 25 \quad \checkmark \quad [5]$$

- 15 (a) Calculate length DF in this triangle.

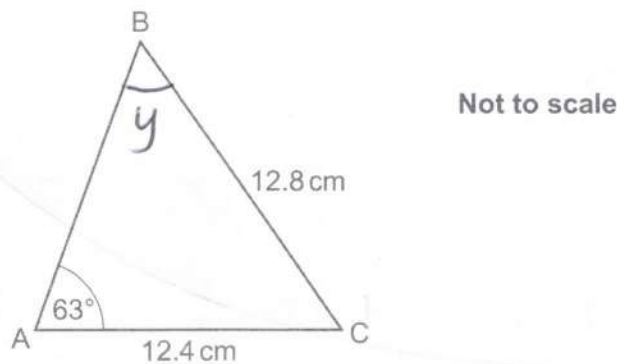


$$x^2 = 12^2 + 10^2 - 2 \times 12 \times 10 \times \cos 30 \quad \checkmark \checkmark$$

$$x = \sqrt{36.153}$$

(a) 6.01 cm [3] ✓

- (b) Calculate angle ACB in this triangle.



$$\sin y = \frac{\sin 63}{12.8} \times 12.4 \quad \checkmark \checkmark$$

$$y = \sin^{-1}(0.863) \\ = 59.7 \quad \checkmark$$

$$180 - 63 - 59.7 \\ 57.3 \quad \checkmark$$

(b) ° [4]

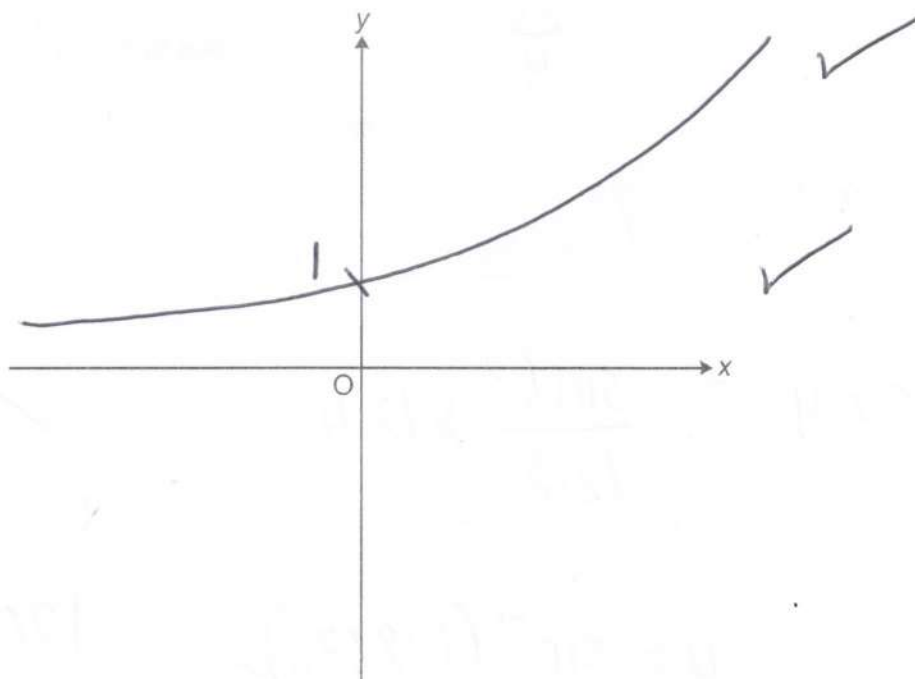
- 16 Show that $\frac{x+9}{x^2-1} + \frac{4}{x+1}$ can be written in the form $\frac{a}{x-1}$, where a is an integer. [4]

$$\frac{x+9}{(x+1)(x-1)} + \frac{4(x-1)}{(x+1)(x-1)} \quad \checkmark$$

$$\frac{x+9+4x-4}{(x+1)(x-1)} \quad \checkmark$$

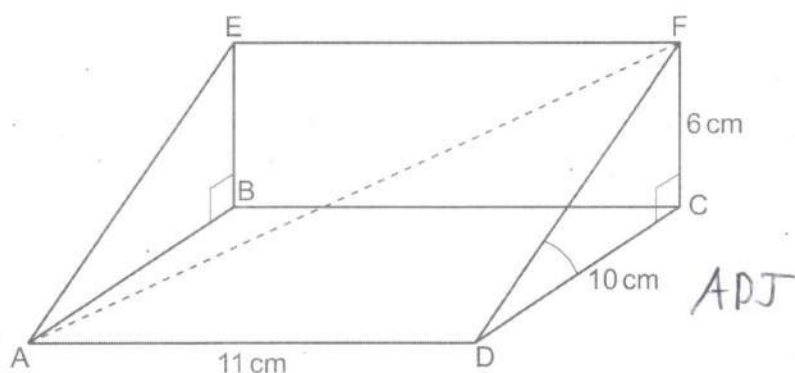
$$\frac{5x+5}{(x+1)(x-1)} = \frac{5(x+1)}{(x+1)(x-1)} = \frac{5}{x-1} \quad \checkmark$$

- 17 Sketch the graph of $y = 3^x$.
Give the value of the y-intercept.



[2]

- 18 The diagram shows a right-angled triangular prism ABCDEF.



Length AD = 11 cm, length CD = 10 cm and length CF = 6 cm.

- (a) Calculate the volume of the prism.

$$\frac{1}{2} \times 10 \times 6 \times 11 \quad \checkmark$$

(a) 330 cm³ [2] $\checkmark$

- (b) Use trigonometry to show that angle FDC = 31°, correct to the nearest degree. [2]

$$\angle FDC = \tan^{-1}\left(\frac{6}{10}\right) = 30.96 \dots \checkmark$$

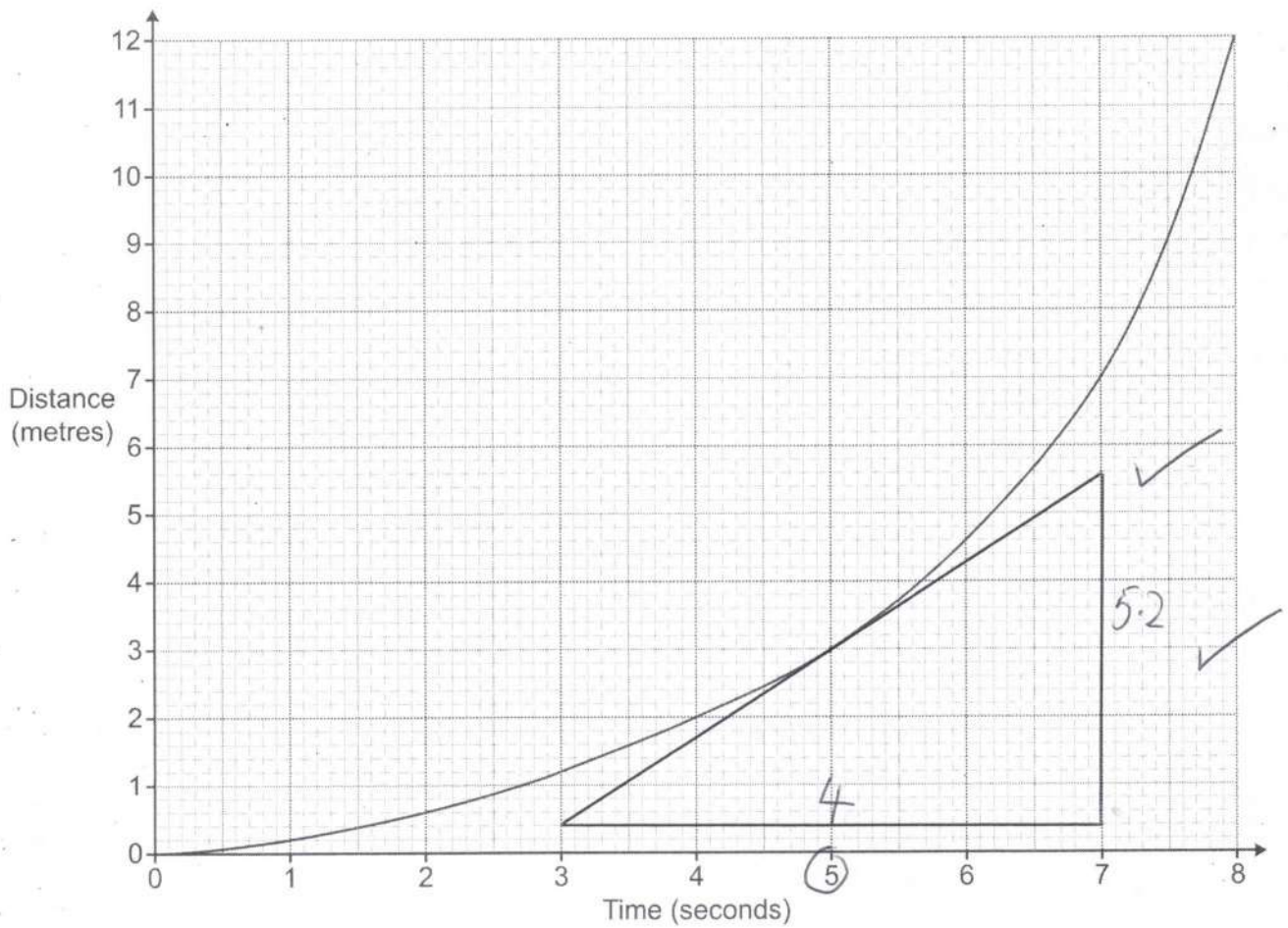
$$= 31^\circ \quad \checkmark$$

- (c) Calculate the exact length of AF.

$$AF = \sqrt{11^2 + 10^2 + 6^2} \quad \checkmark \checkmark \checkmark$$

(c) $\sqrt{257}$ cm [4] $\checkmark$

19 The graph shows the distance travelled by a particle over 8 seconds.



Estimate the speed of the particle at 5 seconds.

$$\frac{5.2}{4}$$



[ms 1.0 → 1.4]

1.3 ✓

..... m/s [4]

END OF QUESTION PAPER