1. The functions f and g are defined by

$$f(x) = 7 - 2x^2, \qquad x \in \mathbb{R}$$

$$g(x) = \frac{3x}{5x - 1}, x \in \mathbb{R}, x \neq 5$$

a. State the range of f

(1)

b. Find $gf(1.8)$

(2)

c. Find $g^{-1}(x)$

(2)

Question	Scheme	Marks	AOs
2(a)	$y \leqslant 7$	B1	2.5
		(1)	
(b)	$f(1.8) = 7 - 2\times1.8^2 = 0.52 \Rightarrow gf(1.8) = g(0.52) = \frac{3\times0.52}{5\times0.52-1} = \ldots$	M1	1.1b
	$gf(1.8) = 0.975$ oe e.g. $\frac{39}{40}$	A1	1.1b
		(2)	
(c)	$y = \frac{3x}{5x-1} \Rightarrow 5xy - y = 3x \Rightarrow x(5y-3) = y$	M1	1.1b
	$\left(g^{-1}(x) =\right)\frac{x}{5x-3}$	A1	2.2a
		(2)	
			(5 marks)

Notes

(a)

B1: Correct range. Allow f(x) or f for y. Allow e.g. $\{y \in \mathbb{R}: y \leqslant 7\}$, $-\infty < y \leqslant 7$, $(-\infty, 7]$

(b)

M1: Full method to find f(1.8) and substitutes the result into g to obtain a value.
Also allow for an attempt to substitute $x = 1.8$ into an attempt at gf(x).

E.g. $\quad gf(x) = \frac{3(7-2x^2)}{5(7-2x^2)-1} = \frac{3(7-2(1.8)^2)}{5(7-2\times(1.8)^2)-1} = \ldots$

A1: Correct value

(c)

M1: Correct attempt to cross multiply, followed by an attempt to factorise out x from an xy term and an x term.
If they swap x and y at the start then it will be for an attempt to cross multiply followed by an attempt to factorise out y from an xy term and a y term.

A1: Correct expression. Allow equivalent correct expressions e.g. $\frac{-x}{3-5x}$, $\frac{1}{5} + \frac{3}{25x-15}$

Ignore any domain if given.

2. A car has six forward gears.

The fastest speed of the car

- in 1st gear is 28 km/h
- in 6th gear is 115 km/h

Given that the fastest speed of the car in successive gears is modelled by an **arithmetic sequence**

a. find the fastest speed of the car in 3rd gear.

(3)

Given that the fastest speed of the car in successive gears is modelled by a **geometric sequence**,

b. find the fastest speed of the car in 5th gear

(3)

Question	Scheme	Marks	AOs
5 (a)	Uses $115 = 28 + 5d \Rightarrow d = (17.4)$	M1	3.1b
	Uses $28 + 2 \times "17.4" = ...$	M1	3.4
	$= 62.8$ (km h $^{-1}$)	A1	1.1b
		(3)	
(b)	Uses $115 = 28r^5 \Rightarrow r = (1.3265)$	M1	3.1b
	Uses $28 \times "1.3265^4" = ...$ or $\dfrac{115}{"1.3265"}$	M1	3.4
	$= 86.7$ (km h $^{-1}$)	A1	1.1b
		(3)	
		(6 marks)	
Notes:			

(a)

M1: Translates the problem into maths using n^{th} term $= a + (n-1)d$ and attempts to find d

Look for either $115 = 28 + 5d \Rightarrow d = ...$ or an attempt at $\dfrac{115-28}{5}$ condoning slips

It is implied by use of $d = 17.4$ Note that $115 = 28 + 6d \Rightarrow d = ...$ is M0

M1: Uses the model to find the fastest speed the car can go in 3rd gear using $28 + 2"d"$ or equivalent. This can be awarded following an incorrect method of finding "d"

A1: 62.8 km/ h Lack of units are condoned. Allow exact alternatives such as $\dfrac{314}{5}$

(b)

M1: Translates the problem into maths using n^{th} term $= ar^{n-1}$ and attempts to find r

It must use the 1st and 6th gear and not the 3rd gear found in part (a)

Look for either $115 = 28r^5 \Rightarrow r = ...$ o.e. or $\sqrt[5]{\dfrac{115}{28}}$ condoning slips.

It is implied by stating or using $r =$ awrt 1.33

M1: Uses the model to find the fastest speed the car can go in 5th gear using $28 \times "r^4"$ or $\dfrac{115}{"r"}$ o.e.

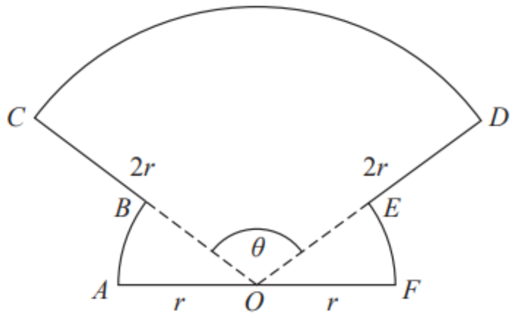
This can be awarded following an incorrect method of finding "r"

A common misread seems to be finding the fastest speed the car can go in 3rd gear as in (a).

Providing it is clear what has been done, e.g. $u_3 = 28 \times "r^2"$ it can be awarded this mark.

A1: awrt 86.7 km/h Lack of units are condoned. Expressions must be evaluated.

3. The shape $OABCDEFO$ shown below is a design for a logo.



In the design

- OAB is a sector of a circle, centre O, radiu r.
- Sector OFE is congruent to sector OAB.
- ODC is a sector of a circle, centre O, radius $2r$.
- AOF is a straight line.

Given that the size of angle COD is θ radians,

a. write down, in terms of θ, the size of angle AOB

(1)

b. Show that the area of the logo is

$$\frac{1}{2}r^2(3\theta + \pi)$$

(2)

c. Find the perimeter of the logo, giving your answer in simplest form in terms of r, θ and π

(2)

6(a)	Angle $AOB = \frac{\pi-\theta}{2}$	B1	2.2a
		(1)	
(b)	Area = $2\times\frac{1}{2}r^2\left(\frac{\pi-\theta}{2}\right)+\frac{1}{2}(2r)^2\theta$	M1	2.1
	$=\frac{1}{2}r^2\pi-\frac{1}{2}r^2\theta+2r^2\theta=\frac{3}{2}r^2\theta+\frac{1}{2}r^2\pi=\frac{1}{2}r^2(3\theta+\pi)$ *	A1*	1.1b
		(2)	
(c)	Perimeter = $4r+2r\left(\frac{\pi-\theta}{2}\right)+2r\theta$	M1	3.1a
	$=4r+r\pi+r\theta$ or e.g. $r(4+\pi+\theta)$	A1	1.1b
		(2)	
			(5 marks)

Notes

(a)

B1: Deduces the correct expression for angle AOB

Note that $\frac{180-\theta}{2}$ scores B0

(b)

M1: Fully correct strategy for the area using their angle from (a) appropriately.

Need to see $2\times\frac{1}{2}r^2\alpha$ or just $r^2\alpha$ where α is their angle in terms of θ from part (a) + $\frac{1}{2}(2r)^2\theta$ with or without the brackets.

A1*: Correct proof. For this mark you can condone the omission of the brackets in $\frac{1}{2}(2r)^2\theta$ as long as they are recovered in subsequent work e.g. when this term becomes $2r^2\theta$

The first term must be seen expanded as e.g. $\frac{1}{2}r^2\pi-\frac{1}{2}r^2\theta$ or equivalent

(c)

M1: Fully correct strategy for the perimeter using their angle from (a) appropriately

Need to see $4r+2r\alpha+2r\theta$ where α is their angle from part (a) in terms of θ

A1: Correct simplified expression

Note that some candidates may change the angle to degrees at the start and all marks are available e.g.

(a) $\dfrac{180-\frac{180\theta}{\pi}}{2}$

(b) $2\left(\dfrac{180-\frac{180\theta}{\pi}}{2}\right)\times\frac{1}{360}\times\pi r^2+\frac{\theta}{360}\times\frac{180}{\pi}\times\pi(2r)^2=\frac{1}{2}\pi r^2-\frac{1}{2}r^2\theta+2r^2\theta=\frac{1}{2}r^2(3\theta+\pi)$

(c) $4r+2\left(\dfrac{180-\frac{180\theta}{\pi}}{2}\right)\times\frac{1}{360}\times2\pi r+\frac{180\theta}{\pi}\times\frac{1}{360}\times2\pi(2r)-4r+\pi r+r\theta$

4. For $\cos\theta \neq 0$, prove that

$$cosec\ 2\theta + \cot 2\theta = \cot\theta$$

(4)

Q	Marking Instructions	AO	Marks	Typical Solution
9(a)	Uses cosec2θ = $\frac{1}{\sin 2\theta}$ and cot2θ= $\frac{\cos 2\theta}{\sin 2\theta}$	1.2	B1	$\frac{1}{\sin 2\theta}+\frac{\cos 2\theta}{\sin 2\theta}$ $=\frac{1+\cos 2\theta}{\sin 2\theta}$ $=\frac{1+cos^2\theta-sin^2\theta}{2\sin\theta cos\theta}$ $=\frac{2cos^2\theta}{2\sin\theta cos\theta}$ $=\frac{cos\theta}{\sin\theta}=cot\theta$
	Uses the identity for sin2θ = 2sinθ*cosθ* or an identity for cos2θ = cos$^2\theta$ – sin$^2\theta$ *or* 2cos$^2\theta$ – 1 or 1 – 2sin$^2\theta$ to commence proof	2.1	M1	
	Uses the identities for sin2θ and cos2θ in correct proof	1.1b	A1	
	Completes a reasoned argument leading to a single trigonometric fraction to prove given identity **AG**	2.1	R1	

5. a and b are two positive irrational numbers.

The sum of a and b is rational.

The product of a and b is rational.

Caroline is trying to prove $\frac{1}{a} + \frac{1}{b}$ is rational.

Here is her proof.

Step 1

$$\frac{1}{a} + \frac{1}{b} = \frac{2}{a+b}$$

Step 2 2 is rational and $a + b$ is non-zero and rational.

Step 3 Therefore $\frac{2}{a+b}$ is rational.

Step 4 Hence $\frac{1}{a} + \frac{1}{b}$ is rational

a. Identify Caroline's mistake.

(1)

b. Prove by contradiction that the difference between any rational number and any irrational number is irrational.

Q	Marking instructions	AO	Mark	Typical solution
7(a)(i)	Identifies the error lies in step 1 without contradiction.	2.3	E1	Mistake is $\frac{1}{a} + \frac{1}{b} = \frac{2}{a+b}$
	Subtotal		**1**	

7(b)	States assumption to begin proof by contradiction may PI by $\frac{a}{b} - x = \frac{c}{d}$ *or* $x - \frac{a}{b} = \frac{c}{d}$	3.1a	M1	Assume that the difference between a rational and an irrational number is rational. $\frac{a}{b} - x = \frac{c}{d}$
	Uses language and notation correctly to state initial assumptions: States their a, b, c and d are integers **and** x is irrational do not accept the irrational written as a fraction Condone missing $b, d \neq 0$	2.5	A1	Where a, b, c and d are integers, $b, d \neq 0$ and x is irrational
	Demonstrates that x can be expressed as a rational number by obtaining $x = \frac{ad - cb}{bd}$ OE	1.1b	M1	$x = \frac{a}{b} - \frac{c}{d}$ $= \frac{ad}{bd} - \frac{cb}{bd}$ $= \frac{ad - cb}{bd}$
	Completes rigorous argument to prove the required result, clearly explaining where the contradiction lies with **ALL** assumptions correct at the start (including $b, d \neq 0$)	2.1	R1	Hence x is rational. This is a contradiction hence the difference of any rational number and any irrational number is irrational.
	Subtotal		**4**	

6. Show that

$$\sum_{n=2}^{\infty}\left(\frac{3}{4}\right)^n \cos(180n)° = \frac{9}{28}$$

(3)

Question	Scheme	Marks	AOs
9	$a=\left(\frac{3}{4}\right)^2$ or $a=\frac{9}{16}$ or $r=-\frac{3}{4}$	B1	2.2a
	$\sum_{n=2}^{\infty}\left(\frac{3}{4}\right)^n \cos(180n)° = \frac{\frac{9}{16}}{1-\left(-\frac{3}{4}\right)} = \ldots$	M1	3.1a
	$=\frac{9}{28}$ *	A1*	1.1b
		(3)	
	Alternative 1:		
	$\sum_{n=1}^{\infty}\left(\frac{3}{4}\right)^n \cos(180n)° = \frac{-\frac{3}{4}}{1-\left(-\frac{3}{4}\right)} = \ldots$ or $r=-\frac{3}{4}$	B1	2.2a
	$\sum_{n=2}^{\infty}\left(\frac{3}{4}\right)^n \cos(180n)° = -\frac{3}{7}-\left(-\frac{3}{4}\right)$	M1	3.1a
	$=\frac{9}{28}$ *	A1*	1.1b

B1: Deduces the correct value of the **first** term or the common ratio. The correct first term can be seen as part of them writing down the sequence but must be the **first** term.
M1: Recognises that the series is infinite geometric and applies the sum to infinity GP formula with $a=\frac{9}{16}$ and $r=\pm\frac{3}{4}$
A1*: Correct proof
Alternative 1:
B1: Deduces the correct value for the sum to infinity (starting at $n = 1$) or the common ratio
M1: Calculates the required value by subtracting the first term from their sum to infinity
A1*: Correct proof
Alternative 2:
B1: Deduces the correct value of the **first** term or the common ratio.
M1: Splits the series into "odds" and "evens", attempts the sum of both parts and calculates the required value by adding both sums
A1*: Correct proof
Alternative 3:
B1: Deduces the correct value of the **first** term
M1: A complete method by taking out the first term, expresses the rhs in terms of the original sum and rearranges for "S"
A1*: Correct proof

7.

$$f(x)=\frac{50x^2+38x+9}{(5x+2)^2(1-2x)},\quad x\neq -\frac{2}{5},\qquad x\neq \frac{1}{2}$$

Given that $f(x)$ can be expressed n the form

$$\frac{A}{5x+2}+\frac{B}{(5x+2)^2}+\frac{C}{1-2x}$$

Where A, B and C are constants.

a. i. find the value of B and the value of C.

ii. show that $A=0$

(4)

b. i. Use binomial expansions to show that, in ascending powers of x,

$$f(x)=p+qx+rx^2+\cdots$$

where p, q and r are simplified fractions to be found.

ii. Find the range of values for x for which the expansion is valid.

(7)

Question	Scheme	Marks	AOs
9(a)(i)	$50x^2+38x+9\equiv A(5x+2)(1-2x)+B(1-2x)+C(5x+2)^2$ $\Rightarrow B=\ldots$ or $C=\ldots$	M1	1.1b
	$B=1$ and $C=2$	A1	1.1b
(a)(ii)	E.g. $x=0$ $x=0\Rightarrow 9=2A+B+4C$ $\Rightarrow 9=2A+1+8\Rightarrow A=\ldots$	M1	2.1
	$A=0$*	A1*	1.1b
		(4)	
(b)(i)	$\frac{1}{(5x+2)^2}=(5x+2)^{-2}=2^{-2}\left(1+\frac{5}{2}x\right)^{-2}$ or $(5x+2)^{-2}=2^{-2}+\ldots$	M1	3.1a
	$\left(1+\frac{5}{2}x\right)^{-2}=1-2\left(\frac{5}{2}x\right)+\frac{-2(-2-1)}{2!}\left(\frac{5}{2}x\right)^2+\ldots$	M1	1.1b
	$2^{-2}\left(1+\frac{5}{2}x\right)^{-2}=\frac{1}{4}-\frac{5}{4}x+\frac{75}{16}x^2+\ldots$	A1	1.1b
	$\frac{1}{(1-2x)}=(1-2x)^{-1}=1+2x+\frac{-1(-1-1)}{2!}(2x)^2+.$	M1	1.1b
	$\frac{1}{(5x+2)^2}+\frac{2}{1-2x}=\frac{1}{4}-\frac{5}{4}x+\frac{75}{16}x^2+\ldots+2+4x+8x^2+\ldots$	dM1	2.1
	$=\frac{9}{4}+\frac{11}{4}x+\frac{203}{16}x^2+\ldots$	A1	1.1b
(b)(ii)	$\lvert x\rvert<\frac{2}{5}$	B1	2.2a
		(7)	
			(11 marks)

8. **In this question you must show all stages of your working.**

Solutions relying entirely on calculator technology are not acceptable.

a. Show that

$$cosec\,\theta - \sin\theta \equiv \cos\theta\cot\theta, \qquad \theta \neq 180n°, \qquad n \in \mathbb{Z}$$

(3)

b. Hence, or otherwise, solve for $0 < x < 180°$,

$$cosec\,x - \sin x = \cos x\cot(3x - 50)$$

Question	Scheme	Marks	AOs
12 (a)	States or uses $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$	B1	1.2
	$\operatorname{cosec}\theta - \sin\theta = \frac{1}{\sin\theta} - \sin\theta = \frac{1-\sin^2\theta}{\sin\theta}$	M1	2.1
	$= \frac{\cos^2\theta}{\sin\theta} = \cos\theta \times \frac{\cos\theta}{\sin\theta} = \cos\theta\cot\theta$ *	A1*	2.1
		(3)	
(b)	$\operatorname{cosec}x - \sin x = \cos x\cot(3x-50°)$ $\Rightarrow \cos x\cot x = \cos x\cot(3x-50°)$		
	$\cot x = \cot(3x-50°) \Rightarrow x = 3x - 50°$	M1	3.1a
	$x = 25°$	A1	1.1b
	Also $\cot x = \cot(3x-50°) \Rightarrow x + 180° = 3x - 50°$	M1	2.1
	$x = 115°$	A1	1.1b
	Deduces $x = 90°$	B1	2.2a
		(5)	
			(8 marks)
Notes:			

a) Condone a full proof in x (or other variable) instead of θ's here

(5)

B1: States or uses $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$ Do not accept $\operatorname{cosec}\theta = \frac{1}{\sin}$ with the θ missing

M1: For the key step in forming a single fraction/common denominator

E.g. $\operatorname{cosec}\theta - \sin\theta = \frac{1}{\sin\theta} - \sin\theta = \frac{1-\sin^2\theta}{\sin\theta}$. Allow if written separately $\frac{1}{\sin\theta} - \sin\theta = \frac{1}{\sin\theta} - \frac{\sin^2\theta}{\sin\theta}$

Condone missing variables for this M mark

A1*: Shows careful work with all necessary steps shown leading to given answer. See scheme for necessary steps. There should not be any notational or bracketing errors.

(b) Condone θ's instead of x's here

M1: Uses part (a), cancels or factorises out the $\cos x$ term, to establish that one solution is found when $x = 3x - 50°$.

You may see solutions where $\cot A - \cot B = 0 \Rightarrow \cot(A-B) = 0$ or $\tan A - \tan B = 0 \Rightarrow \tan(A-B) = 0$.

As long as they don't state $\cot A - \cot B = \cot(A-B)$ or $\tan A - \tan B = \tan(A-B)$ this is acceptable

A1: $x = 25°$

M1: For the key step in realising that $\cot x$ has a period of 180° and a second solution can be found by solving $x + 180° = 3x - 50°$. The sight of $x = 115°$ can imply this mark provided the step $x = 3x - 50°$ has been seen. Using reciprocal functions it is for realising that $\tan x$ has a period of 180°

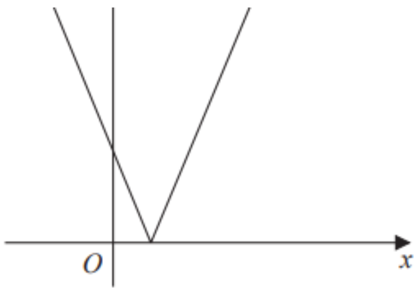
A1: $x = 115°$ Withhold this mark if there are additional values in the range (0,180) but ignore values outside.

B1: Deduces that a solution can be found from $\cos x = 0 \Rightarrow x = 90°$. Ignore additional values here.

9. The diagram below shows a sketch of the equation

$$y = |2x - 3k|$$

where k is a positive constant.



a. Sketch the graph with equation $y = f(x)$ where

$$f(x) = k - |2x - 3k|$$

Stating

- coordinates of the maximum point
- the coordinates of any points where the graph meets the coordinate axes

(4)

b. Find, in terms of k, the set of values of x for which

$$k - |2x - 3k| > x - k$$

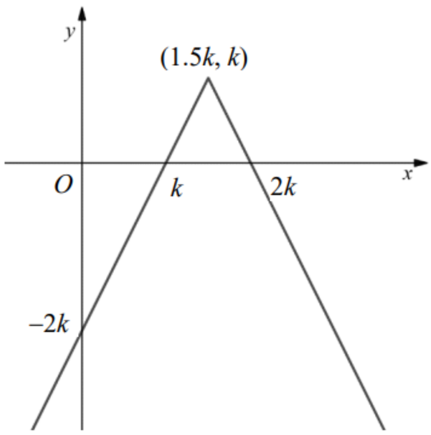
Give your answer in set notation.

(4)

c. Find, in terms of k, the minimum point of the graph

$$y = 3 - 5f\left(\frac{1}{2}x\right)$$

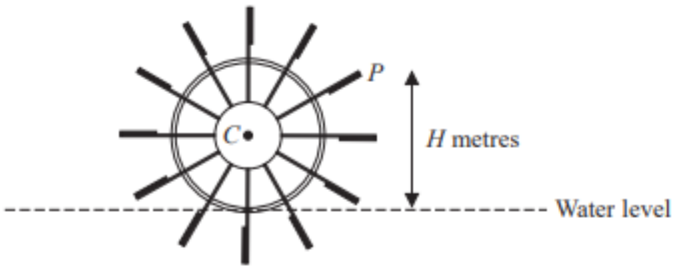
(2)

11(a)			
	$\wedge$ shape in any position	B1	1.1b
	Correct x-intercepts or coordinates	B1	1.1b
	Correct y-intercept or coordinates	B1	1.1b
	Correct coordinates for the vertex of a $\wedge$ shape	B1	1.1b
		(4)	
(b)	$x = k$	B1	2.2a
	$k - (2x - 3k) = x - k \Rightarrow x = ...$	M1	3.1a
	$x = \frac{5k}{3}$	A1	1.1b
	Set notation is required here for this mark $\left\{x : x < \frac{5k}{3}\right\} \cap \{x : x > k\}$	A1	2.5
		(4)	
(c)	$x = 3k$ **or** $y = 3 - 5k$	B1ft	2.2a
	$x = 3k$ **and** $y = 3 - 5k$	B1ft	2.2a
		(2)	
			(10 marks)

10. a. Express $2\cos\theta - \sin\theta$ in the form $R\cos(\theta + \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$

Give the exact value of R and the value of α in radians correct to 3 decimal places

(3)



The figure above shows the cross-section of a water wheel.

The wheel is free to rotate about a fixed axis through the point C.

The point P is at the end of one of the paddles of the wheel.

The water level is assumed to be horizontal and of constant height.

The vertical height, H metres, of P above the water level is modelled by the equation

$$H = 3 + 4\cos(0.5t) - 2\sin(0.5t)$$

where t is the time in seconds after the wheel starts rotating.

Using the model find

b. i. The maximum height of P above the water level

ii. The value of t when the maximum height occurs

Give your answer to 1 decimal place

(3)

In one full rotation, P is below the water line for a total of T seconds.

According to the model.

c. find the value of T.

Give you answer to 3 significant figures.

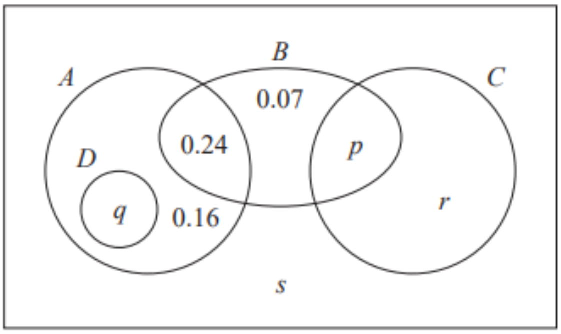
(solutions based solely on calculator technology are not acceptable)

(4)

15(a)	$R = \sqrt{5}$	B1	1.1b
	$\tan\alpha = \frac{1}{2}$ or $\sin\alpha = \frac{1}{\sqrt{5}}$ or $\cos\alpha = \frac{2}{\sqrt{5}} \Rightarrow \alpha = \ldots$	M1	1.1b
	$\alpha = 0.464$	A1	1.1b
		(3)	
(b)(i)	$3 + 2\sqrt{5}$	B1ft	3.4
(ii)	$\cos(0.5t + 0.464) = 1 \Rightarrow 0.5t + 0.464 = 2\pi$ $\Rightarrow t = \ldots$	M1	3.4
	$t = 11.6$	A1	1.1b
		(3)	
(c)	$3 + 2\sqrt{5}\cos(0.5t + 0.464) = 0$ $\cos(0.5t + 0.464) = -\frac{3}{2\sqrt{5}}$	M1	3.4
	$\cos(0.5t + 0.464) = -\frac{3}{2\sqrt{5}} \Rightarrow 0.5t + 0.464 = \cos^{-1}\left(-\frac{3}{2\sqrt{5}}\right)$ $\Rightarrow t = 2\left(\cos^{-1}\left(-\frac{3}{2\sqrt{5}}\right) - 0.464\right)$	dM1	1.1b
	So the time required is e.g.: $2(3.977\ldots - 0.464) - 2(2.306\ldots - 0.464)$	dM1	3.1b
	$= 3.34$	A1	1.1b
		(4)	

Statistics

11. The Venn diagram shows the probabilities associated with four events, A, B, C and D.



a. Write down any pair of mutually exclusive events from A, B, C and D.

(1)

Given that $P(B) = 0.4$

b. find the value of p

(1)

Given also that A and B are independent

c. find the value of q

(2)

Given further that $P(B'|C) = 0.64$

d. find

i. the value of r

ii. the value of s

(4)

Qu 1	Scheme	Marks	AO
(a)	A, C or D, B or D, C	B1 (1)	1.2
(b)	$[p = 0.4 - 0.07 - 0.24 =]$ $\underline{\mathbf{0.09}}$	B1 (1)	1.1b
(c)	A and B independent implies $\mathrm{P}(A)\times 0.4 = 0.24$ or $(q+0.16+0.24)\times 0.4 = 0.24$	M1	1.1b
	so $\mathrm{P}(A) = 0.6$ and $q = \underline{\mathbf{0.20}}$	A1cso (2)	1.1b
(d)(i)	$\mathrm{P}(B' \mid C) = 0.64$ gives $\frac{r}{r+p} = 0.64$ or $\frac{r}{r+"0.09"} = 0.64$	M1	3.1a
	$r = 0.64r + 0.64$ "p" so $0.36r = 0.0576$ so $r = \underline{\mathbf{0.16}}$	A1	1.1b
(ii)	Using sum of probabilities = 1 e.g. "0.6" + 0.07 + "0.25" + s = 1	M1	1.1b
	so $s = \underline{\mathbf{0.08}}$	A1 (4)	1.1b
		(8 marks)	

	Notes
(a)	B1 for one correct pair. If more than one pair they must all be correct. Condone in a correct probability statement such as $\mathrm{P}(A \cap C) = 0$ or correct use of set notation e.g. $A \cap C = \varnothing$ BUT e.g. "P(A) and P(C) are mutually exclusive" alone is B0
(b)	B1 for $p = 0.09$ (Maybe stated in Venn Diagram [VD]) [If values in VD and text conflict, take text or a value used in a later part]
(c)	M1 for a correct equation in one variable for P(A) or q using independence or for seeing **both** $\mathrm{P}(A \cap B) = \mathrm{P}(A)\times\mathrm{P}(B)$ and $0.24 = 0.6 \times 0.4$ A1cso for $q = 0.20$ or exact equivalent (dep on correct use of independence)
Beware	Use of P(A) = 1 – P(B) = 0.6 leading to q = 0.2 scores M0A0
(d)(i)	1st M1 for use of $\mathrm{P}(B' \mid C) = 0.64$ leading to a correct equation in r and possibly p. Can ft their p provided $0 < p < 1$ 1st A1 for $r = 0.16$ or exact equivalent
(ii)	2nd M1 for use of total probability = 1 to form a linear equation in s. Allow p, q, r etc Can follow through their values provided each of p, q, r are in [0, 1) 2nd A1 for s = 0.08 or exact equivalent

End of Paper – Total 75 Marks