Question	Answer	Marks
1	$117 = \frac{9}{2}(2a + 8d)$	**B1**
	Either $91 = S_4$ with 'a' as $a + 4d$ **or** $117 + 91 = S_{13}$ (**M1** for overall approach. **M1** for S_n)	**M1M1**
	Simultaneous Equations → $a = 7$, $d = 1.5$	**A1**
		4

Question	Answer	Marks
2	$\left(kx + \frac{1}{x}\right)^5 + \left(1 - \frac{2}{x}\right)^8$ Coefficient in $\left(kx + \frac{1}{x}\right)^5 = 10 \times k^2$ (**B1** for 10. **B1** for k^2)	**B1B1**
	Coefficient in $\left(1 - \frac{2}{x}\right)^8 = 8 \times -2$	**B2,1,0**
	$10k^2 - 16 = 74 \rightarrow k = 3$	**B1**
		5

Question	Answer	Marks
3(a)	$36 000 × $(1.05)^n$ (**B1** for $r = 1.05$. **M1** method for rth term)	**B1M1**
	$53 200 after 8 years.	**A1**
		3
3(b)	$S_{10} = 36000\dfrac{(1.05^{10}-1)}{(1.05-1)}$	**M1**
	$453 000	**A1**
		2

Question	Answer	Marks
4(a)	$-1 \leqslant \mathrm{f}(x) \leqslant 2$	**B1 B1**
		2
4(b)	$k = 1$	**B1**
	Translation by 1 unit upwards parallel to the y-axis	**B1**
		2
4(c)	$y = -\dfrac{3}{2}\cos 2x - \dfrac{1}{2}$	**B1**
		1

Question	Answer	Marks
5(a)	$x(mx+c) = 16 \to mx^2 + cx - 16 = 0$	**B1**
	Use of $b^2 - 4ac = c^2 + 64m$	**M1**
	Sets to 0 $\to m = \dfrac{-c^2}{64}$	**A1**
		3
5(b)	$x(-4x+c) = 16$ Use of $b^2 - 4ac \to c^2 - 256$	**M1**
	$c > 16$ and $c < -16$	**A1 A1**
		3

Question	Answer	Marks
6(a)	$3(3x+b)+b=9x+4b \rightarrow 10 = 18 + 4b$	**M1**
	$b = -2$	**A1**
	Either $f(14) = 2$ **or** $f^{-1}(x) = 2(x + a)$ etc.	**M1**
	$a = 5$	**A1**
		4
6(b)	$gf(x) = 3\left(\frac{1}{2}x-5\right)-2$	**M1**
	$gf(x) = \frac{3}{2}x-17$	**A1**
		2

Question	Answer	Marks
7(a)	$\dfrac{(1+\sin\theta)^2+\cos^2\theta}{\cos\theta(1+\sin\theta)}$	M1
	Use of $\sin^2\theta+\cos^2\theta=1 \to \dfrac{2+2\sin\theta}{\cos\theta(1+\sin\theta)} \to \dfrac{2}{\cos\theta}$.	M1A1
		3
7(b)	$\dfrac{2}{\cos\theta}=\dfrac{3}{\sin\theta} \to \tan\theta=1.5$	M1
	θ = 0.983 or 4.12 (**FT** on second value for 1st value + π)	A1 A1FT
		3

Question	Answer	Marks
8	Angle AOB = 15 ÷ 6 = 2.5 radians	B1
	Angle BOC = π – 2.5 (**FT** on angle AOB)	B1FT
	BC = 6(π – 2.5) (BC = 3.850)	M1
	sin(π – 2.5) = BX ÷6 (BX = 3.59)	M1
	Either OX = 6cos(π – 2.5) **or** Pythagoras (OX = 4.807)	M1
	XC = 6 – OX (XC = 1.193) → P = 8.63	A1
		6

Question	Answer	Marks
9(a)	$\frac{dy}{dx} = 3(3-2x)^2 \times -2 + 24 = -6(3-2x)^2 + 24$ (**B1** without ×−2. **B1** for ×−2)	**B1B1**
	$\frac{d^2y}{dx^2} = -12(3-2x)\times -2 = 24(3-2x)$ (**B1FT** from $\frac{dy}{dx}$ without – 2)	**B1FT** **B1**
		4
9(b)	$\frac{dy}{dx} = 0$ when $6(3-2x)^2 = 24 \rightarrow 3-2x = \pm 2$	**M1**
	$x = ½, y = 20$ or $x = 2½, y = 52$ (**A1** for both x values or a correct pair)	**A1A1**
		3
9(c)	If $x = ½$, $\frac{d^2y}{dx^2} = 48$ Minimum	**B1FT**
	If $x = 2½$, $\frac{d^2y}{dx^2} = -48$ Maximum	**B1FT**
		2

Question	Answer	Marks
10(a)	Centre is (3, 1)	B1
	Radius = 5 (Pythagoras)	B1
	Equation of C is $(x-3)^2+(y-1)^2=25$ (**FT** on *their* centre)	M1 A1FT
		4
10(b)	Gradient from (3, 1) to (7, 4) = ¾ (this is the normal)	B1
	Gradient of tangent $=-\frac{4}{3}$	M1
	Equation is $y-4=-\frac{4}{3}(x-7)$ or $3y+4x=40$	M1A1
		4
10(c)	*B* is centre of line joining centres → (11, 7)	B1
	Radius = 5 New equation is $(x-11)^2+(y-7)^2=25$ (**FT** on coordinates of B)	M1 A1FT
		3

Question	Answer	Marks
11(a)	Simultaneous equations $\dfrac{8}{x+2} = 4 - ½x$	**M1**
	$x = 0$ or $x = 6 \rightarrow A\ (0, 4)$ and $B\ (6, 1)$	**B1A1**
	At C $\dfrac{-8}{(x+2)^2} = -\dfrac{1}{2} \rightarrow C\ (2, 2)$ (**B1** for the differentiation. **M1** for equating and solving)	**B1** **M1A1**
		6
11(b)	Volume under line $= \pi\int\left(-\tfrac{1}{2}x+4\right)^2 dx = \pi\left[\dfrac{x^3}{12} - 2x^2 + 16x\right] = (42\pi)$ (**M1** for volume formula. **A2,1** for integration)	**M1** **A2,1**
	Volume under curve $= \pi\int\left(\dfrac{8}{x+2}\right)^2 dx = \pi\left[\dfrac{-64}{x+2}\right] = (24\pi)$	**A1**
	Subtracts and uses 0 to 6 $\rightarrow 18\pi$	**M1A1**
		6