| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 1 | $3x+2>8+x \rightarrow x>3$ | **B1** | |
| | $-3x-2>8+x$ | **M1** | Correct inequality oe |
| | $x<-2.5$ | **A1** | |
| 2 | $x^2+x\left(\frac{2}{3}x-2\right)=9$ | **M1** | Eliminate $y$ |
| | $5x^2-6x-27=0$ | **A1** | |
| | $(x-3)(5x+9)=0$ | **M1** | Factorise or formula |
| | (3, 0) | **A1** | Or both $x$ values |
| | $\left(-\frac{9}{5},-\frac{16}{5}\right)$ | **A1** | |
| 3 | Uses $\lg 100=2$ or $3\lg x=\lg x^3$. | **B1** | |
| | Uses $\lg a+\lg b=\lg ab$ or $\lg a-\lg b=\lg\left(\frac{a}{b}\right)$ | **B1** | |
| | $\lg\left(\frac{100x^3}{y}\right)$ | **B1** | Correct final answer |
| 4(a) | $\frac{dy}{dx}=\frac{\cos x-3\sin x}{\sin x+3\cos x}$ | **3** | **M1** for attempt at chain rule must have function in numerator and denominator<br>**A1** for denominator<br>**A1** for numerator |
| (b) | $-2\cos x-3\cos x=\sin x-6\sin x$ | **M1** | Expand and collect terms in $\sin x$ and $\cos x$ |
| | $1=\tan x$ | **M1** | Use $\frac{\sin x}{\cos x}=\tan x$ |
| | $x=\frac{\pi}{4}$ | **A1** | Must be radians |
| 5 | $a^5+5a^4bx+10a^3b^2x^2$ | **2** | **B1** for powers or for coefficients |
| | $a^5+\left(a^5+5a^4b\right)x+\left(10a^3b^2+5a^4b\right)x^2$ | **2** | **M1** for multiplying to obtain 5 terms<br>**A1** for all correct |
| | $a^5=32 \rightarrow a=2$ | **A1** | |
| | $32+80b=-208 \rightarrow b=-3$ | **A1** | |
| | $10\times8\times9+5\times16\times-3=c \rightarrow c=480$ | **A1** | |

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| 6(a) | $\tan 15° = \dfrac{\sqrt{3}-1}{\sqrt{3}+1}$ | **M1** | Correct use of tan |
| | $\tan 15° = \dfrac{\left(\sqrt{3}-1\right)}{\left(\sqrt{3}+1\right)} \times \dfrac{\left(\sqrt{3}-1\right)}{\left(\sqrt{3}-1\right)}$ | **M1** | Multiply by $\left(\sqrt{3}-1\right)$ |
| | $\tan 15° = 2-\sqrt{3}$ | **A1** | **AG** So all working must be seen |
| 6(b) | $(BC)^2 = \left(\sqrt{3}-1\right)^2 + \left(\sqrt{3}+1\right)^2$ | **M1** | Correct use of Pythagoras |
| | $BC = \sqrt{8}$ or $2\sqrt{2}$ | **A1** | |
| 7(a) | $\mathrm{p}\left(\dfrac{1}{2}\right) = 2\left(\dfrac{1}{8}\right) - 3\left(\dfrac{1}{4}\right) - 23\left(\dfrac{1}{2}\right) + 12 = 0$ | **B1** | Working must be seen |
| 7(b) | $\mathrm{p}(x) = (2x-1)\left(x^2 - x - 12\right)$ | **2** | **M1** for terms $x^2$ and $-12$<br>**A1** for $-x$ |
| | $\mathrm{p}(x) = (2x-1)(x-4)(x+3)$ | **2** | **M1** for solving quadratic<br>**A1** for all three correct factors |
| | $\mathrm{f}(x) = 0 \rightarrow x = \dfrac{1}{2}, 4, -3$ | **A1** | |
| 8(a) | $40 = A \times b^{10}$ and $45 = A \times b^{13}$ | **B1** | |
| | $b^3 = \dfrac{45}{40}$ | **M1** | Divide to find $b^3$. |
| | $b = 1.04$ | **A1** | |
| | $A = 27$ | **A1** | |
| 8(b) | 59 | **B1** | $P = 27 \times 1.04^{20}$ |
| 8(c) | $100 = 27 \times 1.04^t$ | **M1** | Insert $P = 100$ in their expression |
| | $t = \dfrac{\log\left(\dfrac{100}{27}\right)}{\log 1.04}$ oe | **M1** | Rearrange to make $t$ the subject |
| | $t = 33.4 \rightarrow$ Year 2034 | **A1** | |
| 9(a) | $v = 2\mathrm{e}^{2t} - 10\mathrm{e}^t - 12$<br>$a = 4\mathrm{e}^{2t} - 10\mathrm{e}^t$ | **3** | **M1** for correctly differentiating $\mathrm{e}^{2t}$.<br>**A1** for $v$ correct<br>**A1** for $a$ correct |