OCR Additional Maths 2016 – Unofficial Mark Scheme

Q.1	$1-2x+6>4x$ *(correct expansion of bracket)*	B1
	$7>6x$	M1
	$x<\frac{7}{6}$ or $1\frac{1}{6}$	A1

Q.2	$y=\int(3x^2-4x+2)\ dx=x^3-2x^2+2x+c$	M1B1
	$3=(1)^3-2(1)^2+2(1)+c$	M1
	$c=2$	
	$y=x^3-2x^2+2x+2$	A1

Q.3	$3\tan x=4$	M1
	$\tan x=\frac{4}{3}\ \Rightarrow\ x=\tan^{-1}\frac{4}{3}$	M1
	$x=53.1°$ to 1 d.p. in first quadrant *(or awrt 53°)*	B1
	$x=233.1°$ to 1 d.p. in first quadrant *(or awrt 233°)*	B1

Q.4	(i) $\mathrm{f}(2)=(2)^3-(2)^2+(2)-6=0$	
	Hence $(x-2)$ is a factor. *(Must draw this conclusion for mark)*	A1
	(ii) $f(x)=(x-2)(x^2+x+3)$ *by algebraic division or by equating coeffs*	B1
	For x^2+x+3, $b^2-4ac=(1)^2-4(1)(3)=-11$	M1B1
	$b^2-4ac<0$ so the quadratic has no real roots. Hence the cubic only has one root of $x=2$.	A1
	(Must draw correct conclusion for mark.)	

Q.5	(i) Smallest length of AB is 11.5 cm	A1
	(ii) Triangle with sides AB = 11.5, BC = 15.5 & AC = 20.5 cm	B1
	$\cos B=\dfrac{(11.5)^2+(15.5)^2-(20.5)^2}{2(11.5)(15.5)}$ (use of cosine rule to find B)	M1
	$B=97.697...$ $=97.7°$ to 3 s.f.	A1

Q.6 (i) *Method 1:* Difference in acceleration = 0.5 m/s²

$s = ut + \frac{1}{2}at^2 \Rightarrow 100 = \frac{1}{2}(0.5)t^2$ M1

$t = 20$ seconds B1

Method 2:

For B: $s = 0 + \frac{1}{2}(2)t^2 = t^2$

For A: $s = 100 + 0 + \frac{1}{2}(1.5)t^2 = \frac{3}{4}t^2$ *(initial position is at s = 100)* M1

Sub for s in the second equation: $t^2 = 100 + \frac{3}{4}t^2 \Rightarrow t = 20$ seconds B1

Distance travelled by B: $s = t^2 = 400$ m M1A1

(ii) Speed of B: $v = u + at = 0 + (2)(20) = 40$ m/s M1A1

Q.7 (i) Triangle PQM is right-angled at P with 45° angles at Q and M.

Hence $PQ = PM = 2$ m A1

(ii) $PB^2 = MB^2 + PM^2 = 1.5^2 + 2^2 = 2.5^2$ (note this is a 3/4/5 triangle)

$PB = 2.5$ m B1

Angle *BPQ* = 90°, so $\tan(PBQ) = \dfrac{PQ}{PB} = \dfrac{2}{2.5} = 0.8$ M1B1

Hence angle *PBQ* = 38.659… = 38.7° to 3 s.f. A1

Q.8 (i) $(1+\delta)^3 = 1 + 3\delta + 3\delta^2 + \delta^3$ M1A1

Method mark for expansion using $\binom{n}{r}$ *or Pascal's triangle*

(ii) For $\delta < 1$, as δ becomes smaller, δ^2 and δ^3 become smaller at an even more rapid rate. Hence if δ is sufficiently small, the δ^2 and δ^3 terms in the expansion can be neglected and $(1+\delta)^3 \approx 1 + 3\delta$ A1

(iii) $1 + 3\delta - 0.9(1+\delta) - 0.206 = 0$ M1

$2.1\delta = 0.106$ B1

$\delta = 0.05047...$ (or awrt 0.050) A1

$x = 1 + \delta = 1.050... \quad = 1.05$ to 3 s.f. A1