1. a) $f(x) = x^3 + 10x - 4$

$f(0) = -4$
$f(1) = 7$ } M1

(CONTINUITY) & CHANGE OF SIGN IMPLIES ... E1

b) 0.3973, 0.3937, 0.3939, 0.3939 A3 −1 eeoo

c) $f(x) = x^3 + 10x - 4$ B1 (MAY APPEAR IN (a))

$f(0.393885) = -0.000041$
$f(0.393895) = 0.000064$ } M1

CHANGE OF SIGN + COMMENT E1

2. $\frac{dy}{dx} = \frac{1}{2}(x-3)^{-\frac{1}{2}}$ OE M1

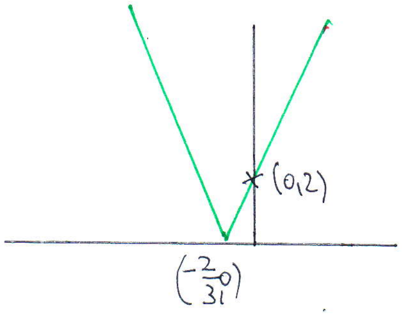
$\left.\frac{dy}{dx}\right|_{x=7} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ A1 ft

NORMAL GRADIENT $= -4$ A1 ft. ft

WHEN $x=7$ $y=2$ OR $(7,2)$ B1

$4x + y = 30$ O.E A1

3. a)



CORRECT SHAPE B1

$(0,2)$ B1

$(-\frac{2}{3}, 0)$ B1

b) $3x+2=1$ OR $3x+2=-1$ M1

$x = -\frac{1}{3}$ A1

$x = -1$ A1

4. (a) $R\cos x\cos\alpha + R\sin x\sin\alpha$ OR $R\cos\alpha = 1$, $R\sin\alpha = \sqrt{3}$ M1

$R = 2$ A1

$\alpha = \frac{\pi}{3}$ A1

(b) MAX IS 2 B1 ft from "their R"

$\cos\left(x - \frac{\pi}{3}\right) = 1$ OR
$2\cos\left(x - \frac{\pi}{3}\right) = 2$ OR
$x - \frac{\pi}{3} = 0$ M1

$x = \frac{\pi}{3}$ A1 c.a.o

(c) $\cos\left(x - \frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$ M1

$\left[\arccos\left(\frac{\sqrt{3}}{2}\right)\right] = \frac{\pi}{6}$ A1

$x - \frac{\pi}{3} = \frac{\pi}{6}$ M1

$x - \frac{\pi}{3} = \frac{11\pi}{6}$ M1

$x = \frac{\pi}{2}$, $x = \frac{\pi}{6}$ A1 both

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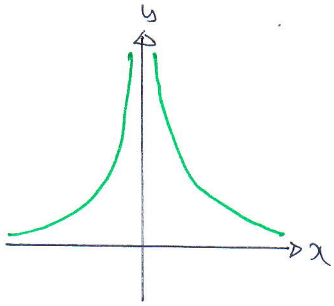
5 a) $3(x^2-4)^2 \times 2x$ M1 M1

b) $1 \times \cos 2x + x[-\sin 2x \times 2]$ M1 M1 M1 dep on "correct structure". e.g. $uv' + vu'$

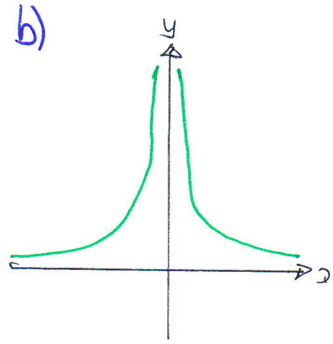
c) $\frac{x\cos x - \sin x}{x^2}$ M1 M1 M1 dep on "correct structure" $\frac{vu' - uv'}{v^2}$

6. a)



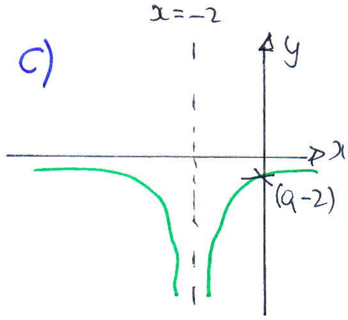
- CORRECT SHAPE & POSITION B1
- ASYMPTOTES $\left.\begin{matrix} x=0 \\ y=0 \end{matrix}\right\}$ B1

b)



- CORRECT SHAPE & POSITION B1
- ASYMPTOTES $\left.\begin{matrix} x=0 \\ y=0 \end{matrix}\right\}$ B1

c)



- CORRECT SHAPE AND POSITION
- $(0,-2)$
- ASYMPTOTES
  $x=-2$
  $y=0$

7.(a) FACTORIZES x^2-4x+3 TO $(x-3)(x-1)$ B1

$\dfrac{2(x-1)-4}{(x-3)(x-3)}$ O.E (e.g 2 SEPARATE FRACTIONS) M1

$\dfrac{2x-6}{(x-3)(x-1)}$ A1

CONVINCINGLY SHOWS $\dfrac{2\cancel{(x-3)}}{\cancel{(x-3)}(x-1)}$ TO ANSWER A1

(b) $y=\dfrac{2}{x-1}$ & ATTEMPTS TO REARRANGE FOR x M1

$x=\dfrac{y+2}{y}$ OR $x=1+\dfrac{2}{y}$ A1

$f^{-1}(x)=\dfrac{x+2}{x}$ OR $f^{-1}(x)=1+\dfrac{2}{x}$ A1 c.a.o

(c) $\dfrac{2}{(2x^2+4)-1}$ OR $\dfrac{2}{2x^2+3}$ M1

$8x^2+12=14$ O.E M1

$x^2=\dfrac{1}{4}$ A1

$x=\pm\dfrac{1}{2}$ BOTH A1

8. $(1+\tan^2 2x)$ seen B1

$6\tan^2 2x + 5\tan 2x - 6 = 0$ o.e. M1

$(3t-2)(2t+3)$ OR $\dfrac{-5 \pm \sqrt{5^2 - 4\times 6\times(-6)}}{2\times 6}$ o.e. M1

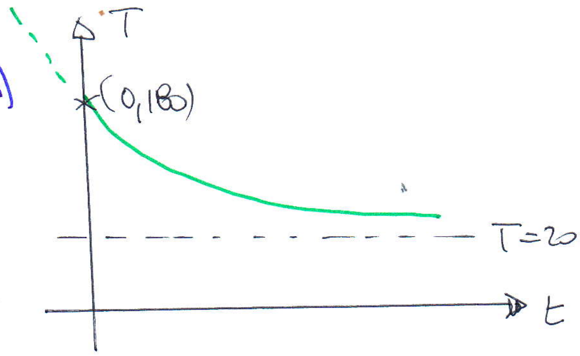
$\tan 2x = \dfrac{2}{3}$, $-\dfrac{3}{2}$ both A1

$2x = 0.588$ OR $2x = -0.983\ldots$ M1

$x = 0.294$ OR $x = -0.491$ M1

$x = 0.29^c, 1.08^c, 1.86^c, 2.65^c$ A1 (IGNORE MORE d.p.)

9. (a)



- SHAPE B1
- (0,180) OR 180 CORRECTLY MARKED B1
- ASYMPTOTE AT T=20 B1

(CONDONE USE OF x & y)

(b) $80 \quad 160e^{-0.1t}$ M1

$e^{-0.1t} = \dfrac{1}{2}$ OR $e^{0.1t} = 2$ M1

$t = 10\ln 2$ OR $t = 6.93$ A1

(c) $\left[\dfrac{dT}{dt} = \right]$ -16 $e^{-0.1t}$ A1 A1

(d) $(-)2 = -16e^{-0.1t}$ ft from (c) B1

$e^{-0.1t} = \dfrac{1}{8}$ A1

$t = 10\ln 8$ OR $t \simeq 20.79\ldots$ OR $T = 20 + 160\times\dfrac{1}{8}$ M1

$T = 40$ OR $T = 40.0$ A1