MATHEMATICAL METHODS (CAS)

Unit 2
Targeted Evaluation Task for School-assessed Coursework 3

2015 Modelling task on circular functions for Outcomes 2 & 3

SOLUTIONS & RESPONSE GUIDE

Total marks for this task = 50
Note: Student marks must be divided by 2.5 to give the correct marks for the outcomes.

Allocation of marks for Outcomes

Outcome 2 = 15
Outcome 3 = 5

Question 1

a. $Period = \frac{2\pi}{\left(\frac{\pi}{3}\right)} = 6$

$Amplitude = 200$

2 marks

b. $Max = 1200$ 1 mark

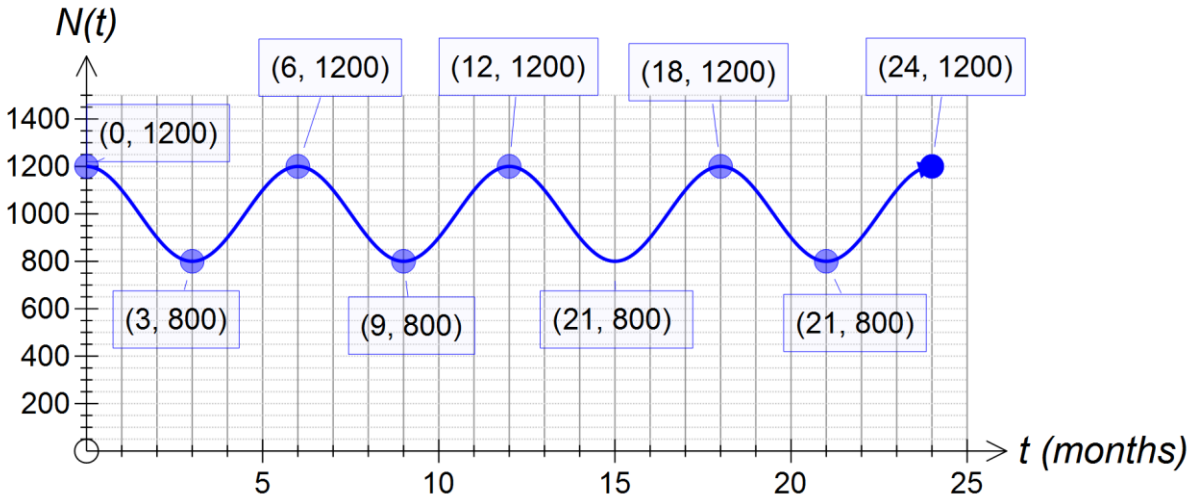
$Min = 800$ 1 mark

c. $Solve\ \ 800 = 1000 + 200\cos\left(\frac{\pi t}{3}\right)\ \ over\ \ 0 \leq t \leq 6$ 1 mark

$t = 3$

After 3 months. 1 mark

d.



3 marks

e. $N(10) = 900$ 1 mark

f. $for\ 4\ months$ 1 mark

$N(10) = N(14) = 900$ 1 mark

g. $After\ 7\ months$ 1 mark

$1\ August\ 2013$ 1 mark

h. $1200 - 1000 = 200$ 1 mark

Question 2

a. $b = 20$ (vertical translation of 20 units)

1 mark

b. $\frac{2\pi}{n} = 12$

$n = \frac{\pi}{6}$ 2 marks

c. $a = 5$

Distance between the mean position and the max.

$f(x) = 5\sin\left(\frac{\pi t}{6}\right) + 20$ 2 marks

d. $Range$: $[15, 25]$

1 mark

e. After 3 hours and 15 hours

$10am\ and\ 10pm$ 2 marks

f. After 7 hours and 11 hours

$T(7) = 17.5℃$ 2 marks

g. $T(t) = 18.5℃$

$t = 6.582,\ 11.418,\ 18.582,\ 23.418$

$1.35pm,\ 6.25pm,\ 1.35am\ (next\ day),\ 6.25am\ (next\ day)$ 3 marks

Question 3

a. $Period = \frac{\pi}{n}$ 1 mark

b. $\frac{3\pi}{2} = \frac{\pi}{2n}\ \ gives\ n = \frac{1}{3}$ 2 marks

c. $1 = \text{atan}(0) + b\ \ gives\ b = 1$

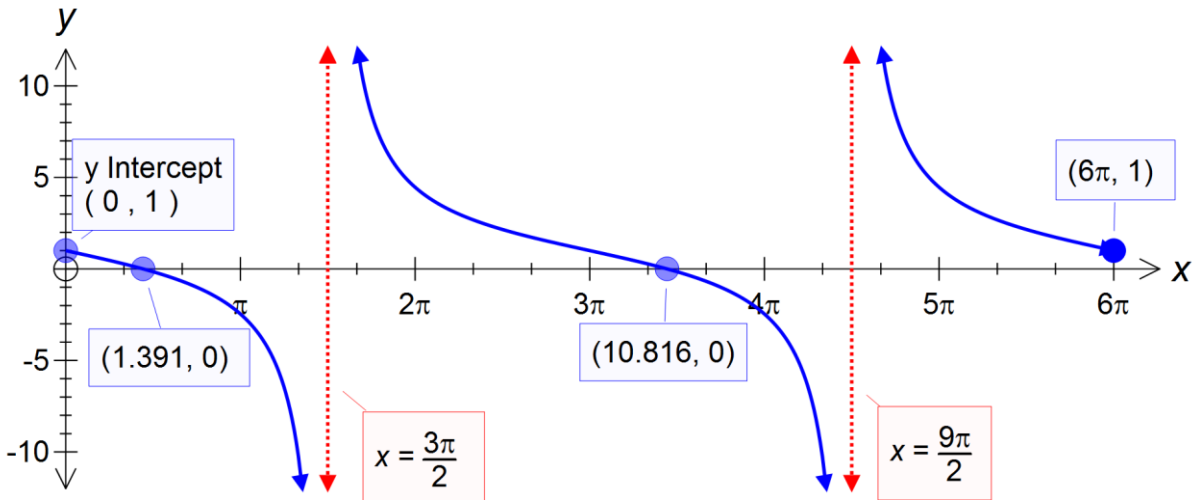
2 marks

d. $1 - 2\sqrt{3} = atan\left(\frac{\pi}{3}\right) + 1$

$a = -2$

$f(x) = -2\tan\left(\frac{x}{3}\right) + 1$ 3 marks

e.



4 marks

Question 4

a. $\frac{2\pi}{n} = 36 \quad gives\ n = \frac{\pi}{18}$

$t = 0, \quad h = 51 \ \ gives\ a + b = 51$

$b = 25 \quad which\ gives \ \ a = 26$ 3 marks

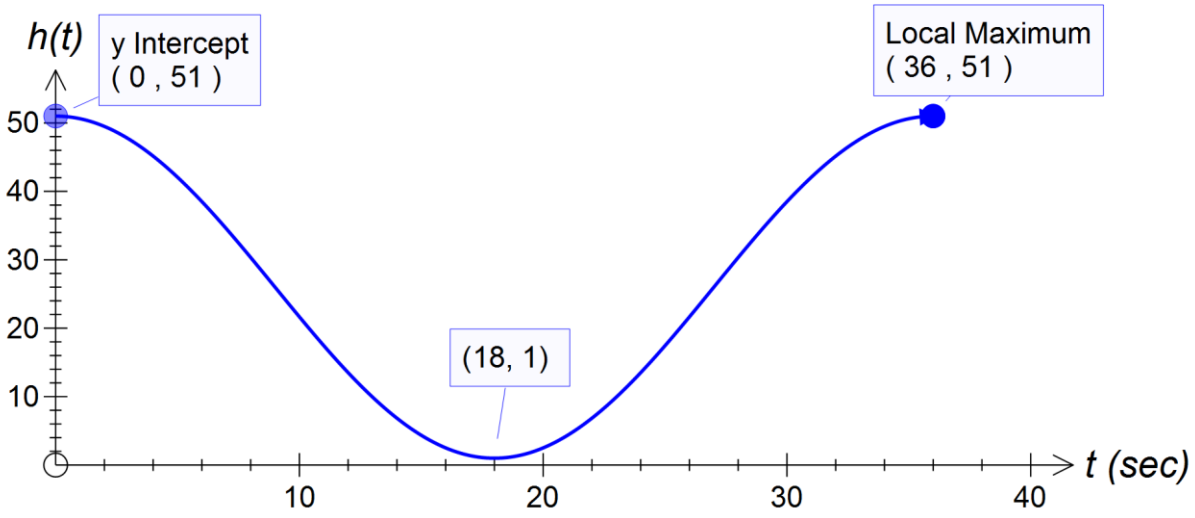
b. $h(t) = 26 + 25\cos\left(\frac{\pi}{18}t\right)$

1 mark

c. $h(45) = 26 + 25\cos\left(\frac{\pi}{18} \times 45\right) = 26m$

1 mark

d.



3 marks

e. $25\cos\left(\frac{\pi}{18}t\right) + 26 = 12$

$t = 12.4056, \ 23.5944$

After 12 seconds and 24 seconds. 2 marks