PENRITH HIGH SCHOOL

2015
HSC TRIAL EXAMINATION

Mathematics Extension 1

General Instructions:

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen
  Black pen is preferred
- Board-approved calculators may be used
- A table of standard integrals is provided at the back of this paper
- In questions 11 – 14, show relevant mathematical reasoning and/or calculations
- Answer each question on a new sheet of paper

Total marks–70

SECTION I **Pages 3–5**

10 marks

- Attempt Questions 1–10
- Allow about 15 minutes for this section

SECTION II **Pages 6–9**

60 marks

- Attempt Questions 11–14
- Allow about 1 hours 45 minutes for this section

Student Number:________________________ **Teacher Name:**________________________

This paper MUST NOT be removed from the examination room

Assessor: T Bales

Section I

10 marks
Attempt Questions 1–10
Allow about 15 minutes for this section

Use the provided multiple–choice answer sheet for Questions 1–10

1 For $x > 1$, $e^x - \ln x$ is:

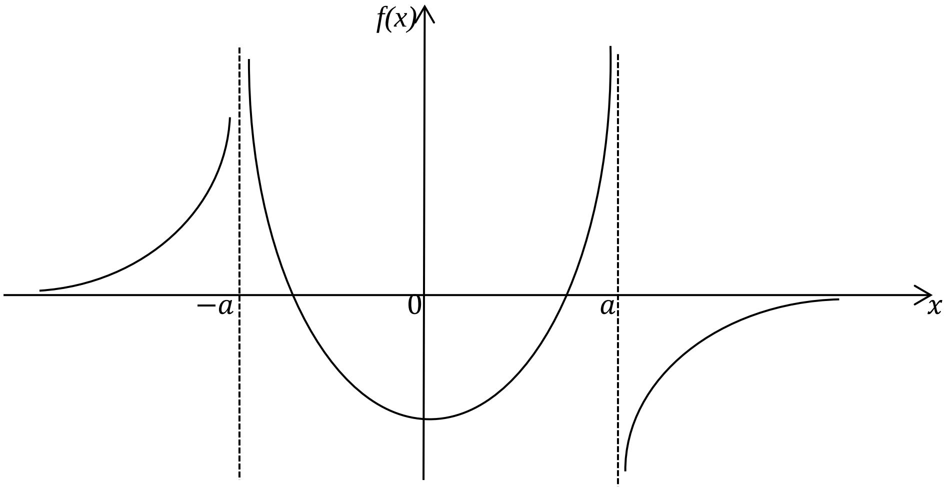
(A) $= 0$

(B) > 0

(C) < 0

(D) $= e$

2 Consider the function $f(x)$ given in the graph below:



Which domain of the function f(x) above is valid for the inverse function to exist?:

(A) $x > 0$

(B) $-a < x < a$

(C) $0 < x < a$

(D) $x < 0$

3 What is the acute angle between the lines $2x - y - 7 = 0$ and $3x - 5y - 2 = 0$?

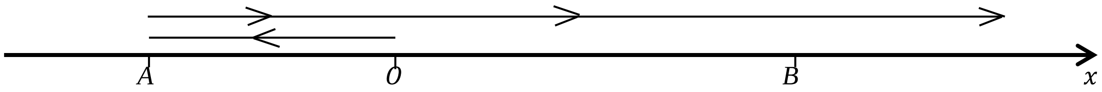
(A) $4°24'$

(B) $32°28'$

(C) $57°32'$

(D) $85°36'$

4 A particle is moving in a straight line with velocity $v\ m/s$ and acceleration $a\ m/s^2$. Initially the particle started moving to the left of a fixed point O. The particle is noticed to be slowing down during the course of the motion from 0 to A. It turns around at A, keeps speeding up for the rest of the course of motion, passing $O$and B and continues. The particle never comes back. Take left to be the negative direction.



During the course of the particle's motion from O to A, which statement of the following is correct?

(A) $v > 0$ and $a > 0$

(B) $v > 0$ and $a < 0$

(C) $v < 0$ and $a > 0$

(D) $v < 0$ and $a < 0$

5 A particle is moving in a straight line with velocity, $v = \frac{1}{1+x}\ m/s$ where x is the displacement of the particle from a fixed point O. If the particle was observed to have reached the position $x = -2\ m$ at a certain moment of time, then this particle:

(A) will definitely reach the position $x = 1m$

(B) may reach the position $x = 1m$

(C) will never reach the position $x = 1m$

(D) will come to rest before reaching $x = 1m$

6 If the rate of change of a function $y = f(x)$ at any point is proportional to the value of the function at that point then the function $y = f(x)$ is a:

(A) Polynomial function

(B) Trigonometric function

(C) Exponential function

(D) Quadratic function

7 Let α and β be any two acute angles such that $\alpha < \beta$. Which of the following statements is correct ?

(A) $sin\alpha < sin\beta$

(B) $cos\alpha < cos\beta$

(C) $cosec\alpha < cosec\beta$

(D) $cot\alpha < cot\beta$

8 Which of the following is a primitive function of $sin^2x + x^2$?

(A) $x - \frac{1}{2}sin2x + \frac{x^3}{3} + c$

(B) $\frac{1}{2}x - \frac{1}{4}sin2x + \frac{x^3}{3} + c$

(C) $x - \frac{1}{2}sin2x + 2x + c$

(D) $\frac{1}{2}x - \frac{1}{4}sin2x + 2x + c$

9 Consider the binomial expansion $(1+x)^n = 1 + n_{C_1}x + n_{C_2}x^2 + \cdots + n_{C_n}x^n$.
Which of the following expressions is correct?

(A) ${}^nc_1 + 2\,{}^nc_2 + \cdots + n\,{}^nc_n = n2^{n-1}$

(B) ${}^nc_1 + 2\,{}^nc_2 + \cdots + n\,{}^nc_n = n2^{n+1}$

(C) ${}^nc_1 + {}^nc_2 + \cdots + {}^nc_n = 2^{n-1}$

(D) ${}^nc_1 + {}^nc_2 + \cdots + {}^nc_n = 2^{n+1}$

10 Using the substitution, $u = 1 + \sqrt{x}$, find the value of $\int_1^4 \frac{1}{(1+\sqrt{x})^2}\frac{1}{\sqrt{x}}dx$ is:

(A) $\frac{6}{5}$

(B) $\frac{1}{3}$

(C) $\frac{2}{3}$

(D) $\frac{3}{2}$

Section II

60 marks
Attempt Questions 11–14
Allow about 1 hour and 45 minutes for this section

Begin each question on a new sheet of paper. Extra sheets of paper are available.

In questions 11–14, your responses should include relevant mathematical reasoning and/or calculations

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Question 11 (15 marks) Start a new sheet of paper.

(a) $(x+1)$ and $(x-2)$ are factors of $A(x) = x^3 - 4x^2 + x + 6$. Find the third factor. **2**

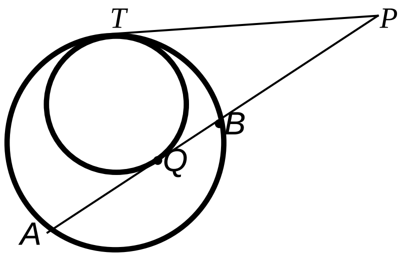
(b) Find the coordinates of the point P which divides the interval AB internally in the ratio $2:3$ with $A(-3,7)$ and $B(15,-6)$ **3**

(c) Solve the inequality $\frac{1}{4x-1} < 2$, graphing your solution on a number line. **3**

(d) Use the method of mathematical induction to prove that, for all positive integers n: **3**

$$1^2 + 3^2 + 5^2 + 7^2 + \cdots + (2n-1)^2 = \frac{n}{3}(2n-1)(2n+1)$$

(e)



PT is the common tangent to the two circles which touch at T.
PA is the tangent to the smaller circle at Q, intersecting the larger circle at points B and A as shown.

i) State the property which would be used to explain why $PT^2 = PA \times PB$ **1**

ii) If $PT = m, QA = n \; and \; QB = r$, prove that $m = \frac{nr}{n-r}$ **3**

Proceed to next page for question (12)

Question 12 (15 marks) Start a new sheet of paper.

(a) The equation $sinx = 1 - 2x$ has a root near $x = 0.3$. Use one application of Newton's methods to find a better approximation, giving your answer correct to 2 decimal places. **3**

(b) Five couples sit at a round table. How many different seating arrangements are possible if:

i) there are no restrictions? **1**

ii) each person sits next to their partner? **2**

(c) In the expansion of $(4 + 2x - 3x^2)\left(2 - \frac{x}{5}\right)^6$, find the coefficient of x^5 **3**

(d) i) Write the binomial expansion for $(1 + x)^n$ **2**

ii) Using part (i), show that $\int_0^3 (1+x)^n \, dx = \sum_{k=0}^{n} \frac{1}{k+1} {}^nC_k 3^{k+1}$ **2**

iii) Hence show that $\sum_{k=0}^{n} \frac{1}{k+1} {}^nC_k 3^{k+1} = \frac{1}{n+1}\left[4^{n+1} - 1\right]$ **2**

Proceed to next page for question (13)

Question 13 (15 marks) Start a new sheet of paper.

(a) Use the substitution $u = \frac{x}{\sqrt{1-x^2}}$ to show that $\frac{d}{dx}\left[tan^{-1}\left(\frac{x}{\sqrt{1-x^2}}\right)\right] = \frac{1}{\sqrt{1-x^2}}$ **3**

(You can use the result that $\int \frac{1}{a^2+x^2}dx = \frac{1}{a}tan^{-1}\frac{x}{a} + c$. You do not need to prove this).

(b) Give the exact value for $\int_{-\sqrt{3}}^{3} \frac{dx}{3+x^2}$ **3**

(c) The distinct points *P*, *Q* have parameters $t = t_1$ and $t = t_2$ respectively on the parabola $x = 2t, y = t^2$. The equations of the tangents to the parabola at *P* and *Q* respectively are given by:
$y - t_1x + {t_1}^2 = 0$ and $y - t_2x + {t_2}^2 = 0$ (You do not need to prove these)

i) Show that the equation of the chord PQ is $2y - (t_1 + t_2)x + 2t_1t_2 = 0$ **2**

ii) Show that *M*, the point of intersection of the tangents to the parabola at P and Q, has coordinates $(t_1 + t_2\ ,\ t_1t_2)$. **2**

iii) $\propto$) Prove that for any value of t_1, except $t_1 = 0$, there are exactly two values of t_2 for which *M* lies on the parabola $x^2 = -4y$. **3**

β) Find these two values of t_2 in terms of t_1. **2**

Proceed to next page for question (14)

Question 14 (15 marks) Start a new sheet of paper.

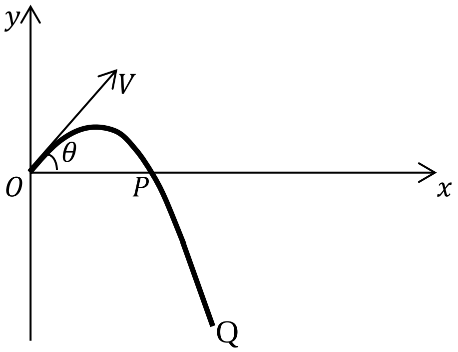
(a) A particle P is moving in simple harmonic motion on the x axis, according to the law $x = 4sin3t$ where x is the displacement of P in centimetres from O at time t seconds.

i) State the period and amplitude of the motion. **2**

ii) Find the first time when the particle is 2cm to the positive side of the origin and it's velocity at this time. **2**

iii) Find the greatest speed and greatest acceleration of P **3**

(b)



A projectile is fired from O, with speed Vms^{-1}, at an angle of elevation of θ to the horizontal. After t seconds, its horizontal and vertical displacements from O (as shown) are x metres and y metres, repectively.

i) Prove that $x = Vtcos\theta$ and $y = -\frac{1}{2}gt^2 + Vtsin\theta$ **3**

ii) Show that the time taken to reach P is given by $t = \frac{2Vsin\theta}{g}$ **2**

iii) The projectile falls to Q, where its angle of depression from O is θ. Prove that, in its flight from O to Q, P is the half-way point in terms of time. **3**

End of paper

STANDARD INTEGRALS

$$\int x^n \, dx = \frac{1}{n+1} x^{n+1}, \; n \neq -1; \; x \neq 0, \text{ if } n < 0$$

$$\int \frac{1}{x} \, dx = \ln x, \; x > 0$$

$$\int e^{ax} \, dx = \frac{1}{a} e^{ax}, \; a \neq 0$$

$$\int \cos ax \, dx = \frac{1}{a} \sin ax, \; a \neq 0$$

$$\int \sin ax \, dx = -\frac{1}{a} \cos ax, \; a \neq 0$$

$$\int \sec^2 ax \, dx = \frac{1}{a} \tan ax, \; a \neq 0$$

$$\int \sec ax \tan ax \, dx = \frac{1}{a} \sec ax, \; a \neq 0$$

$$\int \frac{1}{a^2 + x^2} \, dx = \frac{1}{a} \tan^{-1} \frac{x}{a}, \; a \neq 0$$

$$\int \frac{1}{\sqrt{a^2 - x^2}} \, dx = \sin^{-1} \frac{x}{a}, \; a \neq 0, \; -a < x < a$$

$$\int \frac{1}{\sqrt{x^2 - a^2}} \, dx = \ln\left(x + \sqrt{x^2 - a^2} \right), \; x > a > 0$$

$$\int \frac{1}{\sqrt{x^2 + a^2}} \, dx = \ln\left(x + \sqrt{x^2 + a^2} \right)$$

NOTE: $\ln x = \log_e x, \; x > 0$

Student Number:_____________ Teacher Name:________________

Section I - Multiple Choice

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word *correct* and drawing an arrow as follows.

A ⊗ B ⊗ (correct) C ○ D ○

Start Here →

1. A ○ B ○ C ○ D ○

2. A ○ B ○ C ○ D ○

3. A ○ B ○ C ○ D ○

4. A ○ B ○ C ○ D ○

5. A ○ B ○ C ○ D ○

6. A ○ B ○ C ○ D ○

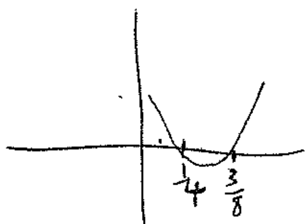
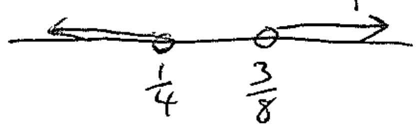
7. A ○ B ○ C ○ D ○

8. A ○ B ○ C ○ D ○

9. A ○ B ○ C ○ D ○

10. A ○ B ○ C ○ D ○

Exam Trial Mathematics Ext MATHEMATICS : Question 11

Suggested Solutions	Marker's Comments
a) $P(3) = 27 - 4\times 9 + 3 + 6$ $= 0$ $\therefore (x-3)$ is third factor.	A lot of students found by polynomial division.
b) $A(-3,7)$ $B(15,-6)$ $\quad M:N = 2:3$ $x = \frac{3(-3)+2(15)}{5} = \frac{21}{5}$ $y = \frac{3(7)+2(-6)}{5} = \frac{9}{5}$ $P\left(\frac{21}{5}, \frac{9}{5}\right)$	Extremely well done. problems occurred with getting signs wrong
c) $\frac{1}{4x-1} < 2$ $4x-1 < 2(4x-1)^2$ $2(4x-1)^2 - (4x-1) > 0$ $(4x-1)[2(4x-1)-1] > 0$ $(4x-1)(8x-3) > 0$  $\therefore x < \frac{1}{4}$ ~~and~~ or $x > \frac{3}{8}$. 	students need to ensure a 'number line' is represented at the end and not shaded regions on a number plane
Mult. Choice 1) B 2) C 3) B 4) C 5) C 6) C 7) A 8) B 9) A 10) B	

Exam	MATHEMATICS : Question......	
	Suggested Solutions	Marker's Comments

d) Test for $n=1$.

$L.H.S = [2(1)-1]^2$

$= 1$

$R.H.S = \frac{1}{3}(1)(3)$

$= 1$

$\therefore$ True for $n=1$

Assume true for $n=k$

$$1^2+3^2+5^2+\cdots+(2k-1)^2 = \frac{k}{3}(2k-1)(2k+1)$$

Test for $n=k+1$

that is we are required to prove

$$1^2+3^2+5^2+\cdots+(2k-1)^2 + (2k+1)^2 = \frac{k+1}{3}(2k+1)(2k+3)$$

$L.H.S = \frac{k}{3}(2k-1)(2k+1) + (2k+1)^2$ by induction assumption

$= (2k+1)\left[\frac{k}{3}(2k-1) + (2k+1)\right]$

$= (2k+1)\left[\frac{2k^2-k}{3} + (2k+1)\right]$

$= (2k+1)\left[\frac{2k^2-k+6k+3}{3}\right]$

$= (2k+1)(\frac{1}{3})(2k^2+5k+3)$

$= \frac{1}{3}(2k+1)(k+1)(2k+3)$

$= \frac{k+1}{3}(2k+1)(2k+3)$

$= R.H.S$ $\therefore$ proved by mathematical induction

Marker's comments: well done, some students didn't realise $S_{k+1} = S_k + T_{k+1}$ and tried to prove $S_{k+1} = T_{k+1}$

e(i) tangent-secant theorem.

Marker's comments: Only brief answer was required.

(ii) $PT=m$ $QA=n$ $QB=r$. $PT^2 = PA \times PB$.

$PT=PQ$ (equal tangents from an external point)

$\therefore PQ = m$

$PA = PQ + PA$ $\quad PB = PQ - QB$

$= m+n$ $\quad = m-r$

$\therefore m^2 = (m+n)(m-r) \Rightarrow \cancel{m^2} = \cancel{m^2} + mn - rm - rn$

$m(n-r) = rn$ $\quad m = \frac{nr}{n-r}$

Marker's comments: students needed to state reason why $PT=PQ$

Exam Trial Mathematics Ext 1 MATHEMATICS : Question 12

Suggested Solutions	Marker's Comments
a) $\sin x = 1-2x$ $f(x)$: $\sin x + 2x - 1 = 0$ $f'(x)$: $\cos x + 2$ $f(a_1) = a - \frac{f(a)}{f'(a)}$ $= 0.3 - \frac{\sin 0.3 + 0.6 - 1}{\cos 0.3 + 2}$ $= 0.33535$ $= 0.34$ to 2 decimal places.	- some students forgot to rearrange to $=0$. - some student put equation around the wrong way so that the numerator and denominator gave a negative overall value.
b)(i) $9!$ (ii) $4! \times 2^5$	- students forgot that all 5 pairs could be swapped between the pair.
c) $(4+2x-3x^2)(2-\frac{x}{5})^6$ General term for $(2-\frac{x}{5})^6$: ${}^6C_k\, 2^{6-k}(-1)^k(\frac{x}{5})^k$ ${}^6C_k\, 2^{6-k} \cdot 5^{-k}(-1)^k x^k$ when $k=5$. multiply by 4 (other brackets) $-{}^6C_5\, 2 \cdot 5^{-5}(4) = \boxed{\frac{-48}{3125}}$ when $k=4$ multiply by 2 (other brackets) ${}^6C_4\, 2^2 5^{-4}(2) = \boxed{\frac{120}{625}}$ when $k=3$ multiply by (-3) (other brackets) $-{}^6C_3\, 2^3 5^{-3}(-3) = \boxed{\frac{480}{125}}$ $\frac{-48}{3125} + \frac{120}{625} + \frac{480}{125} = \frac{12552}{3125}$ or 4.01664	General problems with signs.

Exam Trial Mathematics Ext 1 MATHEMATICS : Question 12	
Suggested Solutions	Marker's Comments

d(i) $(1+x)^n = \binom{n}{0} + \binom{n}{1}x + \binom{n}{2}x^2 + \cdots \binom{n}{n}x^n.$

well done

(ii) $\int_0^3 (1+x)^n\,dx = \int_0^3 \binom{n}{0} + \binom{n}{1}x + \binom{n}{2}x^2 + \cdots \binom{n}{n}x^n\,dx$

$= \left[\binom{n}{0}x + \binom{n}{1}\frac{x^2}{2} + \binom{n}{3}\frac{x^3}{3} + \cdots \binom{n}{n}\frac{x^{n+1}}{n+1}\right]_0^3$

$= \left(3\binom{n}{0} + \binom{n}{1}\frac{3^2}{2} + \binom{n}{2}\frac{3^3}{3} + \cdots \binom{n}{n}\frac{3^{n+1}}{n+1}\right) - 0$

$= \sum_{k=0}^{n} \frac{1}{k+1}\, {}^nC_k\, 3^{k+1}$

students needed to demonstrate integration

(iii) $\int_0^3 (1+x)^n\,dx = \left[\frac{(1+x)^{n+1}}{n+1}\right]_0^3$

$= \frac{4^{n+1}}{n+1} - \frac{1}{n+1} = \frac{1}{n+1}\left[4^{n+1} - 1\right]$

$\therefore$ from (ii)(iii) $\sum_{k=0}^{n} \frac{1}{k+1}\, {}^nC_k\, 3^{k+1} = \frac{1}{n+1}\left[4^{n+1} - 1\right]$

if students realised method they were successful.

Exam Trial Maths Ext 1 MATHEMATICS	: Question 13.
Suggested Solutions	**Marker's Comments**

a) Let $u = \frac{x}{\sqrt{1-x^2}}$ Let $y = \tan^{-1}\left(\frac{x}{\sqrt{1-x^2}}\right)$

$$\boxed{\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}}$$

$$\frac{dy}{du} = \frac{d}{du}(\tan^{-1} u) = \frac{1}{1+u^2}$$

$$\frac{dy}{du} = \frac{1}{1+\frac{x^2}{1-x^2}} = \frac{1}{\frac{1-x^2+x^2}{1-x^2}} = \underline{\underline{1-x^2}}$$

$$u = x(1-x^2)^{-\frac{1}{2}}$$

$$\frac{du}{dx} = x \times \frac{1}{2}(1-x^2)^{-\frac{3}{2}} \times -2x + 1(1-x^2)^{-\frac{1}{2}}$$

$$= \frac{x^2}{(\sqrt{1-x^2})^3} + \frac{1}{\sqrt{1-x^2}} = \underline{\underline{\frac{x^2+1-x^2}{(\sqrt{1-x^2})^3}}}$$

$$\frac{dy}{dx} = (1-x^2) \times \frac{1}{(\sqrt{1-x^2})^3} = \boxed{\frac{1}{\sqrt{1-x^2}}}$$

Marker's comments:

- Some students did not use the given substitution which was required.
- Some students did not seem familiar with $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$
- Note: If you use product rule $u=x$, $v=(1-x^2)^{-\frac{1}{2}}$. For quotient rule $u=x$, $v=(1-x^2)^{\frac{1}{2}}$. Students were mixing these up.

b) $$\int_{-\sqrt{3}}^{3} \frac{1}{3+x^2}\,dx = \frac{1}{\sqrt{3}}\left[\tan^{-1}\frac{x}{\sqrt{3}}\right]_{-\sqrt{3}}^{3}$$

$$= \frac{1}{\sqrt{3}}\left(\tan^{-1}\frac{3}{\sqrt{3}} - \tan^{-1}\frac{-\sqrt{3}}{3}\right)$$

$$= \frac{1}{\sqrt{3}}\left(\tan^{-1}\sqrt{3} - \tan^{-1}(-1)\right)$$

$$= \frac{1}{\sqrt{3}}\left(\frac{\pi}{3} - -\frac{\pi}{4}\right)$$

$$= \underline{\frac{7\pi}{12\sqrt{3}} \left(\text{or } \frac{7\pi\sqrt{3}}{36}\right)}$$

Marker's comments:

- This question was well answered.
- Some students did not know the range of $\tan^{-1}$ to be $-\frac{\pi}{2}$ to $\frac{\pi}{2}$

Exam Trial Maths Ext1 MATHEMATICS : Question....13c	
Suggested Solutions	Marker's Comments
13c i. $m = \frac{t_2^2 - t_1^2}{2t_2 - 2t_1} = \frac{(t_2+t_1)(t_2-t_1)}{2(t_2-t_1)} = \frac{t_2+t_1}{2}$ $y - t_1^2 = \frac{(t_1+t_2)}{2}(x - 2t_1)$ $2y - 2t_1^2 = (t_1+t_2)x - 2t_1^2 - 2t_1t_2$ $2y - (t_1+t_2)x + 2t_1t_2 = 0$	• keep (t_1+t_2) in brackets to avoid complicated algebraic manipulation
ii. $y = t_1x - t_1^2$ $y = t_2x - t_2^2$ $t_1x - t_1^2 = t_2x - t_2^2$ $t_1x - t_2x = t_1^2 - t_2^2$ $x(t_1-t_2) = (t_1+t_2)(t_1-t_2)$ $x = t_1 + t_2$ sub into $y = t_1x - t_1^2$ $y = t_1(t_1+t_2) - t_1^2$ $= t_1^2 + t_1t_2 - t_1^2$ $y = t_1t_2$ $M(t_1+t_2, t_1t_2)$	
iii. $x^2 = -4y$ $(t_1+t_2)^2 = -4(t_1t_2)$ $t_1^2 + 2t_1t_2 + t_2^2 = -4t_1t_2$ $t_1^2 + 6t_1t_2 + t_2^2 = 0$ $\Delta = 36t_1^2 - 4.1.t_1^2$ $= 32t_1^2$ $\Delta > 0$ for all t_1 ∴ 2 values for all t_2	• Some students didn't know where to start. • sub M into $x^2 = -4y$ • use discriminant to show 2 values ie $\Delta > 0$

Exam Ext 1 Maths	MATHEMATICS	: Question...... 13 c iii β

Suggested Solutions	Marker's Comments
$t_2 = \frac{-6t_1 \pm \sqrt{32t_1^2}}{2}$ $= \frac{-6t_1 \pm 4\sqrt{2}\,t_1}{2}$ $= -3t_1 \pm 2\sqrt{2}\,t_1$ $= (-3 \pm 2\sqrt{2})t_1$	Some students found t_1 in terms of t_2

Exam Trial Maths Ext1 MATHEMATICS : Question..14a	
Suggested Solutions	Marker's Comments

ai $x = 4\sin 3t$

amplitude = 4

period $= \frac{2\pi}{n} = \frac{2\pi}{3}$

ii $2 = 4\sin 3t$

$\frac{1}{2} = \sin 3t$

$3t = \frac{\pi}{6}$

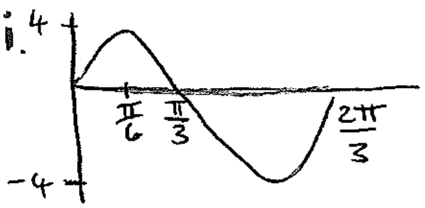
$t = \frac{\pi}{18}$

$\dot{x} = 12\cos 3t$

$= 12\cos 3\left(\frac{\pi}{18}\right)$

$= 6\sqrt{3}$

iii.



max velocity when $t=0$

$\dot{x} = 12\cos 3(0)$

$= 12\text{ cms}^{-1}$

max acceleration when $t = \frac{\pi}{2}$
(positive direction

$\ddot{x} = -36\sin 3t$

$= 36\text{cm}^{-2}$

Marker's Comments:

- errors were made differentiating $x = 4\sin 3t$
- common error $t = \frac{\pi}{18} = 10\text{sec}$
- errors differentiat $\dot{x} = 12\cos 3t$
- using degrees instead of radians
- -36cms^{-2} was accepted

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Suggested Solutions	Marker's Comments
bi. $\ddot{x} = 0$ $\dot{x} = c_1$ when $t=0$ $\dot{x} = v\cos\theta$ $\therefore c_1 = v\cos\theta$ $\dot{x} = v\cos\theta$ $x = vt\cos\theta + c_2$ when $t=0$ $x=0$ $\therefore c_2 = 0$ $x = vt\cos\theta$ $\ddot{y} = -g$ $\dot{y} = -gt + c_3$ when $t=0$ $\dot{y} = v\sin\theta$ $\therefore c_3 = v\sin\theta$ $\dot{y} = -gt + v\sin\theta$ $y = -\frac{gt^2}{2} + vt\sin\theta + c_4$ when $t=0$ $y=0$ $\therefore c_4 = 0$ $y = -\frac{gt^2}{2} + vt\sin\theta$	• errors were common when evaluating constants
bii. $P \rightarrow y=0$ $0 = -\frac{1}{2}gt^2 + vt\sin\theta$ $0 = t\left(v\sin\theta - \frac{gt}{2}\right)$ $t=0$ or $v\sin\theta - \frac{gt}{2} = 0$ $\frac{gt}{2} = v\sin\theta$ $t = \frac{2v\sin\theta}{g}$	
iii. $\tan\theta = \frac{-y}{x}$ $\tan\theta = \frac{-(vt\sin\theta - \frac{1}{2}gt^2)}{vt\cos\theta}$ $\tan\theta = -\tan\theta + \frac{gt}{2v\cos\theta}$ $2\tan\theta = \frac{gt}{2v\cos\theta}$ $\frac{4v\sin\theta}{g} = t$ which is twice $\frac{2v\sin\theta}{g}$	• be careful quoting the cartesian eq'n for the trajectory (a method some used) You may need to derive it.