Sydney Technical High School

Name: ....

Maths Class: ....

Year 11
Mathematics Advanced

Preliminary Course
Assessment 3
September, 2019

Time allowed: 120 minutes

General Instructions:

- Marks for each question are indicated on the question.
- Approved calculators may be used
- All necessary working should be shown
- Full marks may not be awarded for careless work or illegible writing
- ***Begin each question on a new page***
- Write using black or blue pen
- All answers are to be in the writing booklet provided
- A reference sheet is provided.

Section 1 Multiple Choice
Questions 1-10
10 Marks

Section II Questions 11-18
80 Marks

Section I

10 marks

Use Multiple Choice answer sheet for questions 1 – 10

Question 1

If $a = 1 - 2c$, in which expression has c been correctly made the subject?

(A) $c = \frac{-1-a}{2}$

(B) $c = \frac{1-a}{2}$

(C) $c = \frac{a-1}{2}$

(D) $c = \frac{a+1}{2}$

Question 2

In a raffle, 30 tickets are sold and there is one prize to be won. What is the probability that someone buying 6 tickets wins the prize?

(A) $\frac{1}{5}$

(B) $\frac{1}{4}$

(C) $\frac{1}{6}$

(D) $\frac{1}{30}$

Question 3

A function is given by $f(x) = \sqrt{4 - x^2}$. What is its natural domain?

(A) $x < 2$

(B) $x \leq 2$

(C) $-2 \leq x \leq 2$

(D) $-4 \leq x \leq 4$

Question 4

If $5\sqrt{2} - \sqrt{8} + \sqrt{32} = \sqrt{x}$, the value of x is

(A) 130

(B) 98

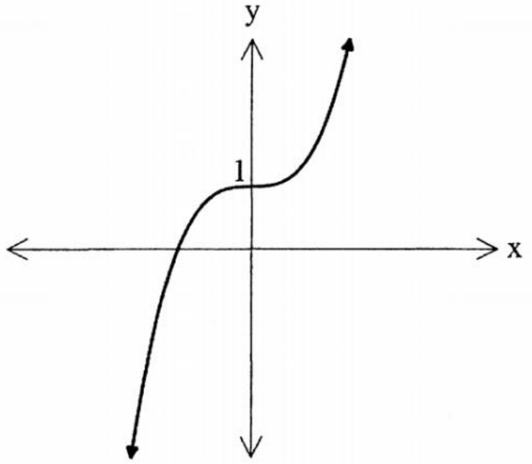
(C) 26

(D) 7

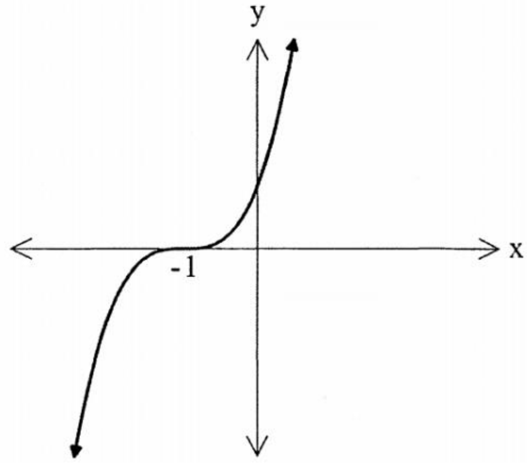
Question 5

The graph of $y = 1 - x^3$ could be

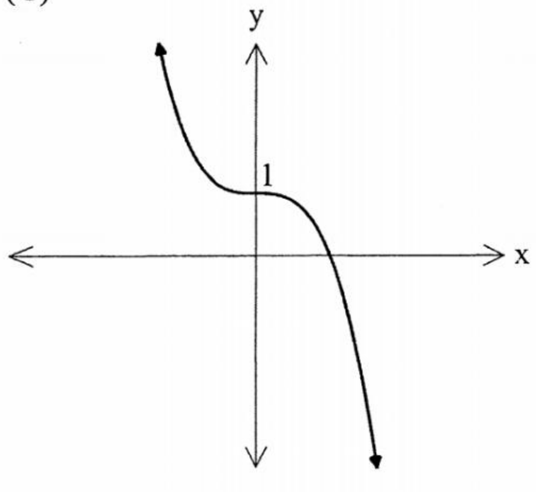
(A)



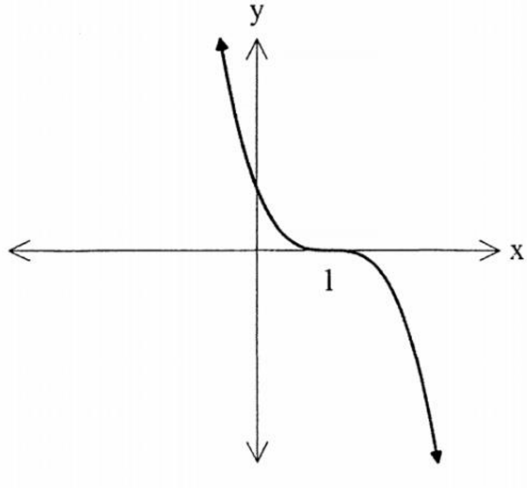
(B)



(C)



(D)



Question 6

What is the derivative of $(x^2 - 7)^4$?

(A) $4(x^2 - 7)^3$

(B) $4(2x - 7)^3$

(C) $8x(x^2 - 7)^3$

(D) $8x(2x - 7)^3$

Question 7

What is the period of $y = sin2x$?

(A) $\frac{\pi}{2}$

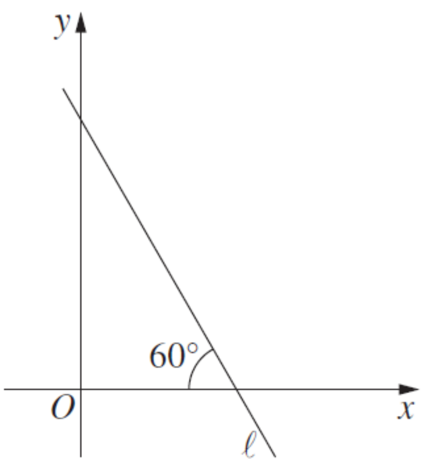
(B) π

(C) 2π

(D) 4π

Question 8

The diagram shows the line l.



What is the slope of line l?

(A) $\frac{1}{\sqrt{3}}$

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

(C) $\sqrt{3}$

(D) $-\sqrt{3}$

Question 9

Simplify $2\log 10 - \log 5$ and choose the correct answer

(A) $\log 4$

(B) $\log 15$

(C) $\log 20$

(D) $\log 95$

Question 10

What is the solution to the equation $2sin2\theta - 1 = 0$ for $0° \leq \theta \leq 360°$

(A) $\theta = 30°\ or\ 150°$

(B) $\theta = 15°\ or\ 75°$

(C) $\theta = 30°, 60°, 210°\ or\ 330°$

(D) $\theta = 15°, 75°, 195°\ or\ 255°$

End of section I

Section II

80 marks

Questions 11 – 18

Answer each question in your writing booklet.

Start each question on a NEW sheet of paper

Question 11 (Start a new page) **10 marks**

a) Evaluate $\frac{\cos 92°}{\tan 130°}$ correct to three decimal places 1

b) Factorise $2x^2 - 5x - 3$ 1

c) Express $495°$ in radians. Leave your answer in terms of π 1

d) Find the exact value $\sin\frac{2\pi}{3}$ 1

e) Solve $|2x + 1| = 3$ 2

f) Rationalise the denominator of $\frac{2}{\sqrt{5}-1}$ 2

g) Solve $2x + 3y = 28$ and $3x + 2y = 27$ simultaneously 2

End of Question 11

Question 12 (Start a new page) **10 marks**

a) Fully factorise $x^3 + x^2y - x - y$ 2

b) Simplify $\frac{2x^2}{x^2 - x - 2} \times \frac{x - 2}{6x}$ 2

c) Differentiate the following

(i) $y = -6x^3 + 4x^2 + 3$ 1

(ii) $y = \frac{3}{x^4}$ 1

d) Evaluate $\lim_{x \to 4} \frac{x^2 - 16}{x - 4}$ 2

e) Find the equation of the line that passes through the point $(5, -7)$ and is perpendicular to the line $y = -5x + 2$. Leave your answer in gradient-intercept form. 2

End of Question 12

Question 13 (Start a new page) **10 marks**

a) Differentiate $f(x) = \sqrt{x^2 - 5}$ 2

b) Consider the function $y = x^2 + 4x + 6$

(i) Find the value of the discriminant 1

(ii) Find the coordinates of the vertex 1

(iii) Sketch the graph, showing all important features. (Use at least $\frac{1}{3}$ of a page) 1

(iv) State the range 1

c) Given $\sin x = \frac{3}{7}$ and $\tan x < 0$, find the exact value of $\cos x$ 2

d) A packet of lollies contains 5 red lollies and 14 green lollies. Two lollies are selected at random without replacement.

(i) What is the probability that the two lollies are red? 1

(ii) What is the probability that the two lollies are different colours? 1

End of Question 13

Question 14 (Start a new page) **10 marks**

a) Differentiate with respect to x: $x^2(2x+1)^5$. Fully factorise your answer 2

b) Find $\frac{dy}{dx}$, given that $y = \frac{x-x^2}{5x+1}$ 2

c) Find the equation of the normal to the curve $y = x^3 + 4x + 7$ at the point where $x = 1$. Leave your answer in general form. 3

d) (i) On a Cartesian plane, draw a neat sketch of the function $y = f(x)$ where 2

$$f(x) = \begin{cases} x^2 - 4 \text{ for } x < 2 \\ 4x - 8 \text{ for } x \geq 2 \end{cases}$$

(ii) Is the function above differentiable at $x = 2$? Justify your answer 1

End of Question 14

Question 15 (Start a new page) **10 marks**

a) The number of bacteria in a culture increases according to the function $B = 2t^4 - t^2 + 2000$, where t is time in hours. Find:

(i) The number of bacteria initially 1

(ii) The rate at which the number of bacteria is increasing after 5 hours 1

b) Given $log_b 2 = 0.43$ and $log_b 3 = 0.68$, evaluate

(i) $log_b 1.5$ 1

(ii) $log_b 2\sqrt{3}$ 2

c) Mr H tries to connect to his internet service provider. The probability that he connects on any single attempt is 0.75.

(i) What is the probability that he connects for the first time on his second attempt? 1

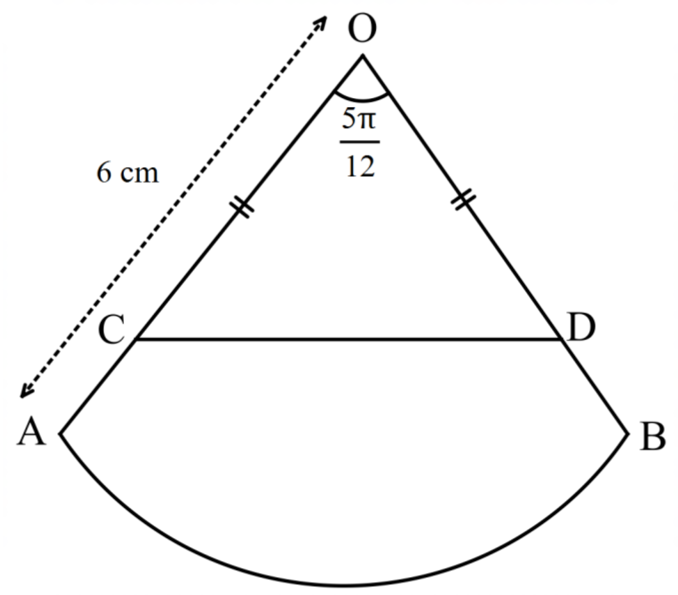
(ii) What is the probability that he is still not connected after his third attempt? 1

d) Differentiate $f(x) = x^2 - 3x$ from first principles 3

End of Question 15

Question 16 (Start a new page) **10 marks**

a) The diagram shows a sector AOB. The length OA is 6 cm and $\angle AOB = \frac{5\pi}{12}$. The points C and D lie on OA and OB respectively and $OC = OD$.



(i) Find the exact area of sector AOB 1

(ii) If the area of triangle COD is half the area of sector AOB, find the length of OC correct to two decimal places (Hint: Let $OC = x$) 2

b) Using at least $\frac{1}{3}$ of your page, draw a neat sketch of the function $f(x) = -(x+1)(x-2)(x-4)$. Label all intercepts. 3

c) Prove that $\tan\theta + \cot\theta = \sec\theta cosec\,\theta$ 2

d) Let $f(x) = \frac{1}{\sqrt{x}}$ and $g(x) = x^2 + 2$

(i) Find $f \circ g(x)$ 1

(ii) Determine whether the composite function from part (i) is odd, even or neither. Justify your answer. 1

End of Question 16

Question 17 (Start a new page) **10 marks**

a) 80 people were surveyed to find out how many of them had visited the cities of Barcelona and Prague. The survey showed that 23 people had visited Barcelona, 18 had visited Prague and 10 people had visited both cities.

(i) What is the probability that a person chosen at random has visited:

α) Barcelona or Prague 1

β) Only one of the two cities 1

γ) Neither city 1

(ii) Find the probability that a person has been to Barcelona, given that they have been to Prague 1

b) Solve $2cos^2x + cosx = 1$ for $0 \leq x \leq 2\pi$ 3

c) Solve $2^{2x} = 5^{x-1}$ 3

(Leave your answer correct to 2 decimal places)

End of Question 17

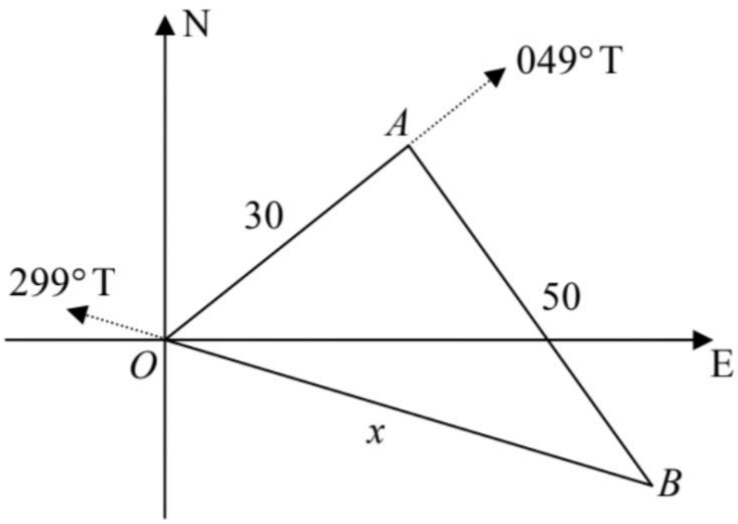
Question 18 (Start a new page) **10 marks**

a) In a game, a turn involves rolling two dice, each with faces marked $0, 1, 2, 3, 4$ and 5. The score for each turn is calculated by multiplying the two numbers uppermost on the dice.

(i) What is the probability of scoring zero on the first turn? 1

(ii) What is the probability that the sum of the scores in the first two turns is less than 45? 2

b) A ship sails for 30 nautical miles from *O* to *A* on a bearing of $049°T$. It then turns and sails to a point *B*, 50 nautical miles away. From *B*, the starting point *O* is observed on a bearing of $299°T$.



(i) Show that $\angle AOB = 70°$ 1

(ii) Show that x satisfies the quadratic equation $x^2 - (60\cos 70°)x - 1600 = 0$ 2

(iii) Hence find the distance of *B* from *O*, giving your answer in nautical miles correct to one decimal place 2

(iv) Calculate the bearing that the ship travelled on from *A* to *B*, correct to the nearest degree 2

End of Question 18

End of Exam ☺

Year 11 2019 Mathematics Advanced Yearly Solutions

Multiple Choice

1. B
2. A
3. C
4. B
5. C
6. C
7. B
8. D
9. C
10. D

1. $a = 1 - 2c$

$2c = 1 - a$

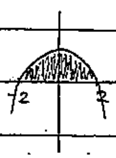
$c = \frac{1-a}{2}$ (B)

2. $P(\text{win}) = \frac{6}{30}$

$= \frac{1}{5}$ (A)

3. $4 - x^2 \geq 0$

$(2-x)(2+x) \geq 0$



D: $-2 \leq x \leq 2$ (C)

4. $5\sqrt{2} - \sqrt{8} + \sqrt{32} = 5\sqrt{2} - 2\sqrt{2} + 4\sqrt{2}$

$= 7\sqrt{2}$

$= \sqrt{98}$

$\therefore x = 98$ (B)

5. (C)

6. $\frac{d}{dx}\left[(x^2-7)^4\right] = 4(x^2-7)^3 \cdot 2x$

$= 8x(x^2-7)^3$ (C)

7. Period $= \frac{2\pi}{2}$

$= \pi$ (B)

8. $m = \tan\theta$

$\theta = 180° - 60°$

$= 120°$

$\therefore m = \tan 120°$

$= -\sqrt{3}$ (D)

9. $2\log 10 - \log 5 = \log 10^2 - \log 5$

$= \log\left(\frac{10^2}{5}\right)$

$= \log 20$ (C)

10. $2\sin 2\theta - 1 = 0 \qquad 0° \leq \theta \leq 360°$

$\sin 2\theta = \frac{1}{2} \qquad 0° \leq 2\theta \leq 720°$

$2\theta = 30°, 150°, 390°, 510°$

$\theta = 15°, 75°, 195°, 255°$ (D)

Question 11

a) 0.029

b) $(2x+1)(x-3)$

c) $495° = 495 \times \frac{\pi}{180}$

$= \frac{11\pi}{4}$

d) $\sin\frac{2\pi}{3} = \sin\frac{\pi}{3}$

$= \frac{\sqrt{3}}{2}$

e) $|2x+1| = 3$

$2x+1 = \pm 3$

$2x+1 = 3 \quad$ or $\quad 2x+1 = -3$

$2x = 2 \qquad 2x = -4$

$x = 1 \qquad x = -2$

f) $\frac{2}{\sqrt{5}-1} \times \frac{(\sqrt{5}+1)}{(\sqrt{5}+1)} = \frac{2\sqrt{5}+2}{5-1}$

$= \frac{2\sqrt{5}+2}{4}$

$= \frac{2(\sqrt{5}+1)}{4}$

$= \frac{\sqrt{5}+1}{2}$

g) $2x + 3y = 28 \quad$ —① $\times 3$

$3x + 2y = 27 \quad$ —② $\times 2$

$6x + 9y = 84$

$-\ 6x + 4y = 54$

$5y = 30$

$y = 6$

sub $y = 6$ into ①

$2x + 3(6) = 28$

$2x + 18 = 28$

$2x = 10$

$x = 5$

$\therefore x = 5,\ y = 6$

Question 12

a) $x^3 + x^2y - x - y = x^2(x+y) - 1(x+y)$

$= (x+y)(x^2-1)$

$= (x+y)(x-1)(x+1)$

b) $\frac{2x^2(x-2)}{(x^2-x-2)\cdot 6x} = \frac{x(x-2)}{3(x-2)(x+1)}$

$= \frac{x}{3(x+1)}$

c) (i) $y = -6x^3 + 4x^2 + 3$

$y' = -18x^2 + 8x$

(ii) $y = 3x^{-4}$

$y' = -12x^{-5}$

$= \frac{-12}{x^5}$

d) $\lim_{x\to 4} \frac{x^2-16}{x-4} = \lim_{x\to 4} \frac{(x-4)(x+4)}{x-4}$

$= \lim_{x\to 4} x+4$

$= 4+4$

$= 8$

12. e) $y=-5x+2$

$m_1=-5$

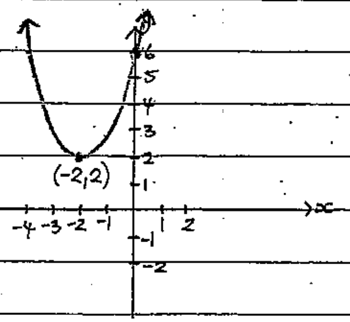
$\therefore m_2=\frac{1}{5}$ $(5,-7)$

$y+7=\frac{1}{5}(x-5)$

$y+7=\frac{1}{5}x-1$

$y=\frac{1}{5}x-8$

(iii)



(iv) Range: $y\geq 2$

Question 13

a) $f(x)=\sqrt{x^2-5}$

$=(x^2-5)^{\frac{1}{2}}$

$f'(x)=\frac{1}{2}(x^2-5)^{-\frac{1}{2}}.2x$

$=x(x^2-5)^{-\frac{1}{2}}$

$=\frac{x}{\sqrt{x^2-5}}$

b) $y=x^2+4x+6$

(i) $\Delta=b^2-4ac$

$=16-4(1)(6)$

$=-8$

(ii) $x=\frac{-b}{2a}$

$=\frac{-4}{2(1)}$

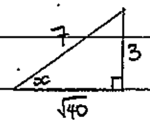
$=-2$

when $x=-2, y=2$

Vertex $(-2,2)$

c) $\sin x=\frac{3}{7}$ $\tan x<0$

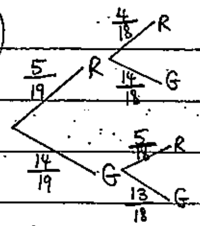
S	A
T	C



$\cos x=\frac{-\sqrt{40}}{7}$

$=\frac{-2\sqrt{10}}{7}$

d)



(i) $P(RR)=\frac{5}{19}\times\frac{4}{18}$

$=\frac{10}{171}$

(ii) $P(RG \text{ or } GR)=\frac{5}{19}\times\frac{14}{18}+\frac{14}{19}\times\frac{5}{18}$

$=\frac{70}{171}$

Question 14

a) $y=x^2(2x+1)^5$ $u=x^2$ $v=(2x+1)^5$

$\frac{du}{dx}=2x$ $\frac{dv}{dx}=5(2x+1)^4.2$

$=10(2x+1)^4$

$\frac{dy}{dx}=(2x+1)^5.2x+x^2.10(2x+1)^4$

$=2x(2x+1)^4[(2x+1)+5x]$

$=2x(2x+1)^4(7x+1)$

b) $y=\frac{x-x^2}{5x+1}$ $u=x-x^2$ $v=5x+1$

$\frac{du}{dx}=1-2x$ $\frac{dv}{dx}=5$

$\frac{dy}{dx}=\frac{(5x+1)(1-2x)-5(x-x^2)}{(5x+1)^2}$

$=\frac{5x-10x^2+1-2x-5x+5x^2}{(5x+1)^2}$

$=\frac{-5x^2-2x+1}{(5x+1)^2}$

c) $y=x^3+4x+7$

$y'=3x^2+4$

when $x=1, y'=3(1)^2+4$

$=7$

$m_T=7$

$\therefore m_N=\frac{-1}{7}$

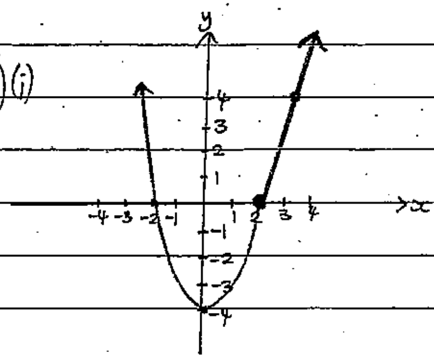
when $x=1, y=12$

Equation of normal: $y-12=-\frac{1}{7}(x-1)$

$7y-84=-x+1$

$x+7y-85=0$

d) (i)



(ii) Yes, the function is smooth and continuous at $x=2$

Question 15

a) (i) $B=2t^4-t^2+2000$

$t=0, B=2000$

$\therefore$ initially there are 2000 bacteria

(ii) $\frac{dB}{dt}=8t^3-2t$

when $t=5, \frac{dB}{dt}=8(5)^3-2(5)$

$=990$

$\therefore$ bacteria increasing at a rate of 990 bacteria/hour

b) (i) $\log_b 1.5=\log_b\left(\frac{3}{2}\right)$

$=\log_b 3-\log_b 2$

$=0.68-0.43$

$=0.25$

(ii) $\log_b 2\sqrt{3}=\log_b 2+\log_b\sqrt{3}$

$=\log_b 2+\log_b 3^{\frac{1}{2}}$

$=\log_b 2+\frac{1}{2}\log_b 3$

$=0.43+\frac{1}{2}\times 0.68$

$=0.77$

15.c) (i) P(connects on second attempt) $= 0.25 \times 0.75$

$= 0.1875$

(ii) P(not connected after third attempt)

$= 0.25 \times 0.25 \times 0.25$

$= 0.015625$

d) $f(x) = x^2 - 3x$

$f'(x) = \lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

$= \lim_{h \to 0} \dfrac{(x+h)^2 - 3(x+h) - (x^2 - 3x)}{h}$

$= \lim_{h \to 0} \dfrac{x^2 + 2xh + h^2 - 3x - 3h - x^2 + 3x}{h}$

$= \lim_{h \to 0} \dfrac{2xh + h^2 - 3h}{h}$

$= \lim_{h \to 0} \dfrac{h(2x + h - 3)}{h}$

$= \lim_{h \to 0} 2x + h - 3$

$= 2x + 0 - 3$

$= 2x - 3$

Question 16

a) (i) Area sector AOB $= \frac{1}{2} r^2 \theta$

$= \frac{1}{2} \times 6^2 \times \frac{5\pi}{12}$

$= \frac{15\pi}{2}$ cm^2

(ii) Area $\Delta COD = \frac{1}{2}$ Area sector AOB

Let $OC = x$

Area $\Delta COD = \frac{1}{2} ab \sin C$

$= \frac{1}{2} x^2 \sin \frac{5\pi}{12}$

$\therefore \frac{1}{2} x^2 \sin \frac{5\pi}{12} = \frac{1}{2} \times \frac{15\pi}{2}$

$x^2 = \frac{15\pi}{4} \div \left(\frac{1}{2} \sin \frac{5\pi}{12}\right)$

$= 24.39$

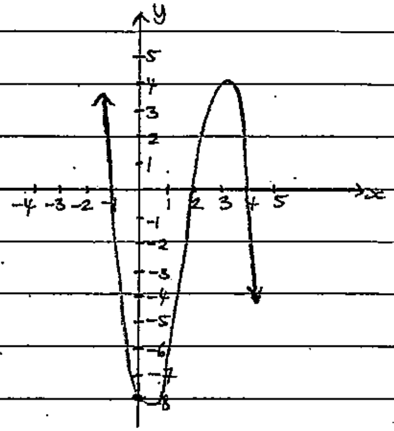
$\therefore x = 4.94$ cm $(x > 0)$

$\therefore OC = 4.94$ cm

b) $f(x) = -(x+1)(x-2)(x-4)$

x-intercepts: $x = -1, 2, 4$

y-intercept: $y = -8$



16.c) $\tan\theta + \cot\theta = \sec\theta \csc\theta$

LHS $= \tan\theta + \cot\theta$

$= \dfrac{\sin\theta}{\cos\theta} + \dfrac{\cos\theta}{\sin\theta}$

$= \dfrac{\sin^2\theta + \cos^2\theta}{\cos\theta \sin\theta}$

$= \dfrac{1}{\cos\theta \sin\theta}$

$= \sec\theta \csc\theta$

$=$ RHS

d) (i) $f(x) = \dfrac{1}{\sqrt{x}}$ $\quad g(x) = x^2 + 2$

$f \circ g(x) = \dfrac{1}{\sqrt{x^2 + 2}}$

(ii) Let $f \circ g(x) = h(x)$

$h(x) = \dfrac{1}{\sqrt{x^2 + 2}}$

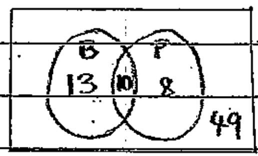
$h(-x) = \dfrac{1}{\sqrt{(-x)^2 + 2}}$

$= \dfrac{1}{\sqrt{x^2 + 2}}$

as $h(x) = h(-x)$, the function is even.

Question 17

a)



(i) α) $P(B \text{ or } P) = \dfrac{13 + 10 + 8}{80}$

$= \dfrac{31}{80}$

β) P(one of the two cities) $= \dfrac{13 + 8}{80}$

$= \dfrac{21}{80}$

γ) P(neither) $= \dfrac{49}{80}$

(ii) P(Barcelona | Prague) $= \dfrac{10}{18}$

$= \dfrac{5}{9}$

b) $2\cos^2 x + \cos x - 1 = 0$ $\quad 0 \le x \le 2\pi$

$(2\cos x - 1)(\cos x + 1) = 0$

$\cos x = \frac{1}{2}$ or $\cos x = -1$

$x = \frac{\pi}{3}, \frac{5\pi}{3}$ or $x = \pi$

$\therefore x = \frac{\pi}{3}, \pi, \frac{5\pi}{3}$

c) $2^{2x} = 5^{x-1}$

$\log_{10} 2^{2x} = \log_{10} 5^{x-1}$

$2x \log_{10} 2 = (x-1) \log_{10} 5$

$2x \log_{10} 2 = x \log_{10} 5 - \log_{10} 5$

$2x \log_{10} 2 - x \log_{10} 5 = -\log_{10} 5$

$x(2\log_{10} 2 - \log_{10} 5) = -\log_{10} 5$

$x = \dfrac{-\log_{10} 5}{2\log_{10} 2 - \log_{10} 5}$

$= 7.21$ (2d.p.)

Question 18

a)

		Die 1					
		0	1	2	3	4	5
	0	0	0	0	0	0	0
	1	0	1	2	3	4	5
Die 2	2	0	2	4	6	8	10
	3	0	3	6	9	12	15
	4	0	4	8	12	16	20
	5	0	5	10	15	20	25

(i) $P(0) = \frac{11}{36}$

(ii) $P(\text{sum} < 45) = 1 - P(\text{sum} \geq 45)$

$P(\text{sum} \geq 45) = P(20,25) + P(25,20) + P(25,25)$

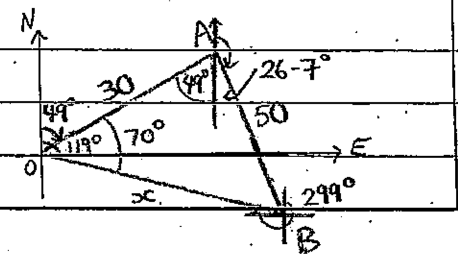
$= \left(\frac{2}{36} \times \frac{1}{36}\right) + \left(\frac{2}{36} \times \frac{1}{36}\right) + \left(\frac{2}{36} \times \frac{1}{36}\right)$

$= \frac{5}{1296}$

$\therefore P(\text{sum} < 45) = 1 - \frac{5}{1296}$

$= \frac{1291}{1296}$

b)



(i) Bearing of O from B is 299°T

$\therefore$ bearing of B from O is $299 - 180 = 119°T$

$\therefore \angle AOB = 119° - 49°$

$= 70°$

(ii) Using cosine rule:

$50^2 = 30^2 + x^2 - 2(30)(x)\cos 70°$

$2500 = 900 + x^2 - 60\cos 70°\, x$

$x^2 - 60\cos 70 x - 1600 = 0$

(iii) $x = \frac{60\cos 70 \pm \sqrt{(60\cos 70)^2 - 4(1)(-1600)}}{2(1)}$

$= 51{\cdot}56,\ -31{\cdot}03 \quad (x > 0)$

$\therefore x = 51{\cdot}6$ (1 d.p.)

$\therefore OB = 51{\cdot}6$ nautical miles

(iv) $\frac{\sin \angle OAB}{51{\cdot}56} = \frac{\sin 70°}{50}$

$\sin \angle OAB = \frac{51{\cdot}56 \times \sin 70°}{50}$

$= 0{\cdot}969\ldots$

$\therefore \angle OAB = 75{\cdot}7°$

$\therefore$ Bearing from A to B $= 180° - 26{\cdot}7°$

$= 153°$ (nearest degree)

Year 11 Mathematics Advanced Teacher Comments

Question 11

c) Some students multiplied by $\frac{180}{\pi}$ rather than $\frac{\pi}{180}$.

d) Several students need to revise finding trigonometric ratios of any magnitude, finding the correct quadrant in both degrees and radians. Students must avoid mistakes such as $\sin(90 + 30) = \sin 90 + \sin 30$

e) Some students only gave one solution to the absolute value equation.

f) Students must know to simplify their final answers, particularly for questions worth more than 1 mark. A large number of students did not take out the common factor in the numerator.

g) Simultaneous equations is a fundamental skill throughout senior years. Students across both Advanced and Extension should ensure that they are completely confident in this process.

Question 12

a) Some students did NOT fully factorise the algebraic expression.
b) Some students did NOT fully simplify the algebraic expression
c) Some students did not factorise the numerator and cancel the term $x - 4$.

Question 13

a) The formula is on the reference sheet. Poor differentiation skills.
Students did not write $x(x^2 - 5)^{-\frac{1}{2}}$ they left out the power of $-\frac{1}{2}$.

b)i) Students need to learn the discriminant rule and be able to apply it.

c) Students did not realise that the angle we are looking for is in the 2nd quadrant where tan $x < 0$.
Cos x is also less than zero meaning the answer is $\frac{-\sqrt{40}}{7}$

d)i) Surprisingly many students were confidents with this question.

dii) Choosing two colours of different colours would be
P(R,G) and P(GR)= $\frac{5}{19} \times \frac{14}{18} + \frac{14}{19} \times \frac{5}{18}$ giving an answer of $\frac{70}{171}$

Question 14

Generally attempts at this question fell well below expectations

a) Many students did not recognise that the product rule was required and blithely differentiated as if x^2 was a constant. Others did not read the question properly and did not fully factorise for full marks
b) Several students made a mistake with copying the formula. Many students lost marks simplifying mainly because of the negative of a negative. Students are encouraged to double-check their algebra to ensure they do not squander easy marks
c) Several students missed the fact that it was the normal and not the tangent. Students need to review their basic coordinate geometry, tangents and normals, and need to understand the concept of a changing gradient for a curve that produces a tangent at a specific point by evaluating to $f'(x)$ through substitution of x *coordinate.*
d) Many students need to review piecewise functions. In particular you do not place a closed and open dot at the crossover point, it is either open (not included) or closed (included), if included, the dot is superfluous in the middle of a function. In this case dot was not required as the function as a whole, was continuous everywhere. Inexplicably, several students swapped the curves.

The cohort as a whole did not demonstrate an understanding of the geometrical and algebraic criteria for differentiability (smoothness, same gradient at junction point) and need to review the differentiability. Continuous does not imply differentiability. Discontinuity however means that a curve cannot be differentiable.

Question 15

(b) (ii) A significant number of students thought the power of ½ applied to the 2 as well, many also did not know the log law where the power needs to be taken out the front.

d) When setting out a first principles question, always work down the page, the lim h approaches 0 must be written on every line except the last where the h has been substituted, also it must be written on the right hand side of the = sign, not as the subject on the left. Formula needs to be written as the first line. Careful in expanding brackets. STUDY THE SOLUTION ON THE ANSWERS CLOSELY. Nobody should be losing marks on a question like this.

Question 16

(a) The formula A $= \frac{1}{2}r^2\emptyset$ uses $\emptyset$ in radians. The triangle area, A $= \frac{1}{2}\ ab\ sin\ \emptyset$ uses $\emptyset$ in degrees or radians (if your calculator has been switches to this function).

(b) This was a great improvement on earlier questions involving sketches. Most people read the instruction "using 1/3 of a page". Marks were awarded for shape and intercepts. Hint: Do not fully label your axes (as in show scales), as you may be creating problems of size. For instance, had the y-intercept been -32 (say), those who used the same x and y axis scales, would have had difficulties pitting it on.

(c) DO NOT work down both sides of an identity, or other "proof" or "show that" question and end up proving something in the middle is equal to itself. You WILL lose marks for this at the HSC.

(d) Question either done really well, or not known at all. You apply the function *g* to x first and then put the result in function *f*. The answer of $\frac{1}{x} + 2$ was an answer to $g^o f(x)$

Question 17

a) Draw and use a Venn diagram correctly.
b) Factorise and equate when you have =0 . Leave your answers in radians when your given domain is in radians
c) Better accuracy is obtained when you round off at the end. Learn log laws correctly

Question 18

a) (i) Draw a diagram!!! By doing so, you can easily read the answer straight off the diagram!
(ii) Many students did not consider the three possible cases for the sum to be greater than 45 (20, 25; 25, 20; and 25, 25) and then find the complementary event.
b) (ii) Wrong use of cosine rule, 50^2 is the subject, NOT x^2 before rearranging cosine rule.
(iii) Your calculator needs to be in degrees mode, not radians! $-b$ of the quadratic formula means you are taking 60cos70, not −60cos70.
(iv) Students found the wrong angle. Important to understand that finding a bearing FROM A to B means start at point A.