Student number

____

2018

TRIAL HSC EXAMINATION

Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using blue or black pen Black pen is preferred
- NESA approved calculators may be used
- A reference sheet is provided
- No liquid paper or correction tape allowed in this examination

Total Marks – 100

Section I:
10 marks

Section II:
90 marks

- Attempt questions 11-16, on separate writing booklets.

TOPICS	M/C	11	12	13	14	15	16	TOTAL
Prelim	/4	/5	/4	/7		/2		/22
Geometry			/3				/6	/9
Calculus	/3	/4		/5	/4	/13		/29
Trig					/2		/9	/11
Exponential / logs	/1	/3		/3				/7
Series	/1		/4		/5			/10
Probability	/1		/4		/4			/9
Quadratics		/3						/3
TOTAL	/10	/15	/15	/15	/15	/15	/15	/100

Section I

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

Use the multiple-choice answer sheet for Questions 1 to 10

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1. Simplify $(2 - 3x) - (5 - 4x)$

(A) $-7x - 3$

(B) $7x + 3$

(C) $x - 3$

(D) $-x - 3$

2. Forty-five balls, numbered 1 to 45, are placed in a barrel, and one ball is drawn at random. What is the probability that the number on the ball drawn is even?

(A) $\frac{21}{45}$

(B) $\frac{22}{45}$

(C) $\frac{23}{45}$

(D) $\frac{24}{45}$

3. What are the coordinates of the focus of the parabola with equation $x^2 = 4(y - 1)$?

(A) $(0, 2)$

(B) $(0, -2)$

(C) $(0, 1)$

(D) $(0, -1)$

4. Rationalise the denominator of $\frac{4}{\sqrt{5}-2}$

(A) $\frac{25-4\sqrt{2}}{27}$

(B) $\frac{25+4\sqrt{2}}{27}$

(C) $\frac{4\sqrt{5}+8}{9}$

(D) $4\sqrt{5}+8$

5. The third term of an arithmetic series is 32 and the sixth term is 17. What is the sum of the first ten terms of the series?

(A) 195

(B) 197

(C) 200

(D) 205

6. What is the value of $f'(2)$ if $f(x)=\frac{1}{3x}$?

(A) $-\frac{1}{12}$

(B) $-\frac{1}{6}$

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

(D) $-\frac{3}{4}$

7. The curve given by $y=7+4x^3-3x^4$ has a stationary point at $(0,7)$. What is the nature of this stationary point?

(A) Relative maximum

(B) Relative minimum

(C) Horizontal point of inflexion

(D) Not a stationary point

8. What is the solution of $5^x = 4$?

(A) $x = \frac{\log_e 4}{5}$

(B) $x = \frac{4}{\log_e 5}$

(C) $x = \frac{\log_e 4}{\log_e 5}$

(D) $x = \log_e\left(\frac{4}{5}\right)$

9. Evaluate $\lim\limits_{x \to 2} \frac{x^3-8}{x^2-4}$

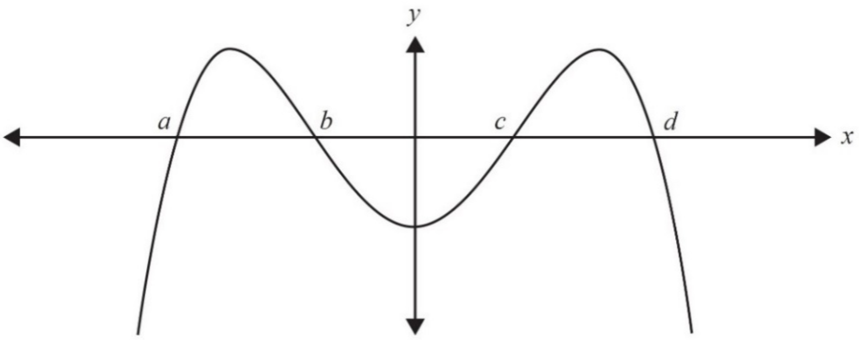
(A) 1

(B) 2

(C) 3

(D) 4

10. The graph of a function *f*, where $f(-x) = f(x)$, is shown below.



The graph has *x*-intercepts at $(a, 0)$, $(b, 0)$, $(c, 0)$ and $(d, 0)$ only. The area bounded by the curve and the *x*-axis on the interval a to d is:

(A) $\int_a^b f(x)dx - \int_c^b f(x)dx + \int_c^d f(x)dx$

(B) $2\int_a^b f(x)dx - 2\int_c^{b+c} f(x)dx$

(C) $2\int_a^b f(x)dx + \int_b^c f(x)dx$

(D) $\int_a^b f(x)dx + \int_c^b f(x)dx + \int_d^c f(x)dx$

End of Section I

Section II

90 marks
Attempt Questions 11 to 16
Allow about 2 hours 45 minutes for this section
Answer each question on separate answer booklets.
All necessary working should be shown in every question.

Question 11 (15 marks) **Start a new writing booklet.**

(a) Find the value of $\frac{1}{7+5\times3}$ correct to three significant figures. **1**

(b) Simplify $\frac{x}{3}+\frac{3x-1}{2}$ **2**

(c) Given that $\log_a b = 2.75$ and $\log_a c = 0.25$, find the value of:

(i) $\log_a\left(\frac{b}{c}\right)$ **1**

(ii) $\log_a(bc)^2$ **2**

(d) Solve $5 - 3x < 7$ **2**

(e) Differentiate $(3x^2+4)^5$ **1**

(f) Find:

(i) $\int \sec^2 6x\, dx$ **1**

(ii) $\int_1^{e^3} \frac{5}{x}\, dx$ **2**

(g) The roots of the equation $x^2+4x+1=0$ are α and β. Find:

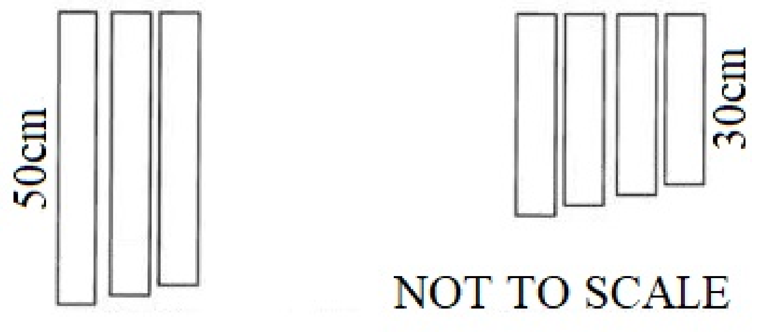
(i) $\alpha+\beta$ and $\alpha\beta$ **1**

(ii) $\frac{1}{\alpha^2}+\frac{1}{\beta^2}$ **2**

End of Question 11

Question 12 (15 marks) **Start a new writing booklet.**

(a)



An instrument, similar to a xylophone has many bars, attached as shown in the diagram. The difference between the lengths of adjacent bars is a constant, so that the lengths of the bars are the terms of an arithmetic series.

The shortest bar is 30cm long and the longest bar is 50cm. The sum of the lengths of all the bars is 1240cm.

(i) Find the number of bars. **2**

(ii) Find the difference in the length between adjacent bars. **2**

(b) **(i)** Draw the graphs of $y = |x|$ and $y = x + 4$ on the same set of axes. **2**

(ii) Find the coordinates of the point of intersection of these two graphs. **2**

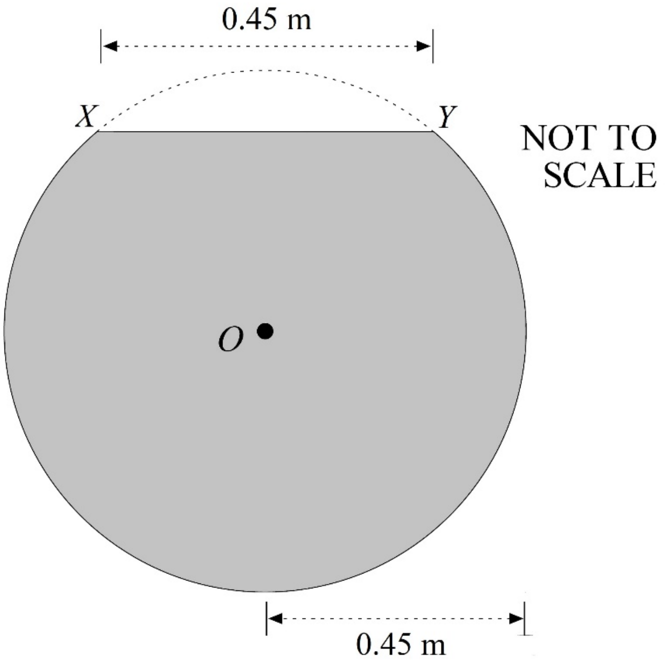
(c) Cameron and Jordan are playing golf. They will play two rounds and each has an equal chance of winning the first round.
If Cameron wins the first round, his probability of winning the second round is increased to 0.6.
If Cameron loses the first round, his probability of winning the second round is reduced to 0.3.

(i) Draw a tree diagram for the two-round sequence. Label each branch of the diagram with the appropriate probability. **2**

(ii) Find the probability that Cameron wins exactly one round. **2**

Question 12 continues on the next page

(d)



A table top is in the shape of a circle with a small segment removed as shown. The circle has centre *O* and radius 0.45 metres. The length of the straight edge is also 0.45 metres.

(i) Explain why $\angle XOY = \frac{\pi}{3}$ **1**

(ii) Find the area of the table-top. **2**

End of Question 12

Question 13 (15 marks) **Start a new writing booklet.**

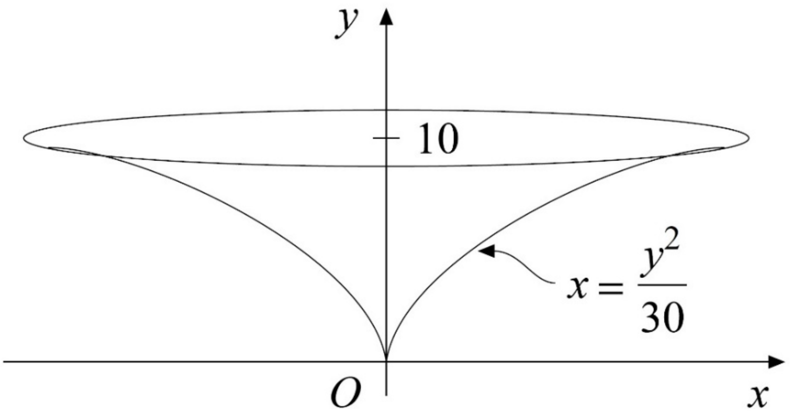
(a) The graph of $y = f(x)$ passes through the point $(1, 3)$ and $f'(x) = 3x^2 - 2$. Find $f(x)$. **2**

(b) A layer of window tinting cuts out 15% of the light and lets through the remaining 85%.

(i) Show that two layers of the window tinting will let through 72.25% of the light. **1**

(ii) How many layers of window tinting is required to cut out at least 90% of the light? **2**

(c) **3**



A glass has a shape obtained by rotating part of the parabola $x = \frac{y^2}{30}$ about the y axis as shown. The glass is 10 cm deep.
Find the volume of liquid which the glass will hold.

(d) **(i)** Prove that the line $y = x + 2$ is a tangent to the parabola $y = x^2 - 5x + 11$. **2**

(ii) Let Q be the point where the line $y = x + 2$ touches the parabola $y = x^2 - 5x + 11$. Show that the normal to the parabola at Q is $y = -x + 8$. **2**

(iii) Find the area of the region enclosed between the parabola and the line $y = -x + 8$. **3**

End of Question 13

Question 14 (15 marks) **Start a new writing booklet.**

(a) Iron is extracted from a mine at a rate that is proportional to the amount of coal remaining in the mine. Hence the amount R remaining after t years is given by

$$R = R_0 e^{-kt},$$

where k is a constant and R_0 is the initial amount of coal.
After 20 years, 50% of the initial amount of coal remains.

(i) Find the exact value of k. **2**

(ii) How many more years will elapse before only 30% of the original amount remains? (Round answer to the nearest month) **2**

(b) By expressing $\sec\theta$ and $\tan\theta$ in terms of $\sin\theta$ and $\cos\theta$, show that **2**

$$\sec^2\theta - \tan^2\theta = 1$$

(c) Craig has invented a game for one person. He rolls two ordinary dice repeatedly until the sum of the two numbers shown is either 7 or 9. If the sum is 9, Craig wins. If the sum is 7, Craig loses. If the sum is any other number, he continues to roll until it is 7 or 9. Given that the probability of Craig winning on his first roll of the dice is $\frac{1}{9}$.

(i) What is the probability that Craig wins on his first, second or third roll? Leave your answer in unsimplified form. **2**

(ii) Calculate the probability that Craig wins the game. **2**

(d) On the 1st of July 2008, Aryan invested \$10 000 in a bank account that paid interest at a fixed rate of 3.2% per annum, compounded annually.
Aryan also added \$1000 to his account on the 1st of July each year, beginning on the 1st of July 2009.

(i) How much was in his account on the 1st of July 2018 after the payment of interest and his deposit? **3**

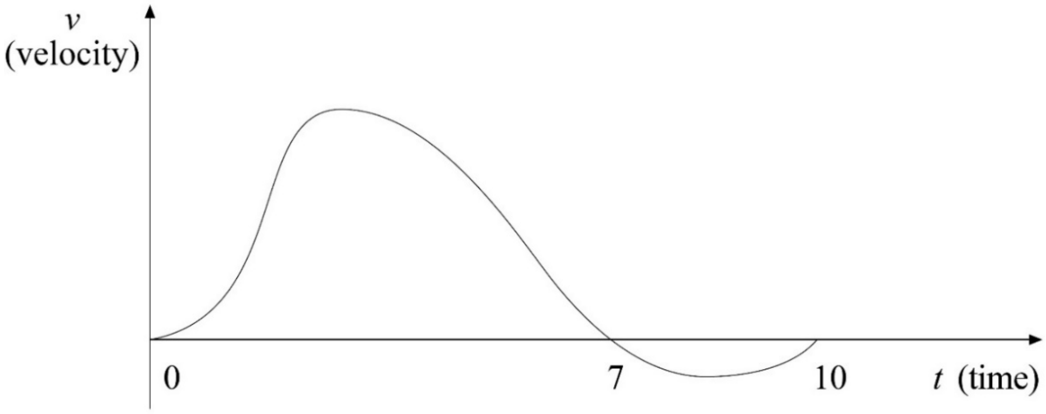
(ii) Aryan's friend, Raj, invested \$10 000 in an account at another bank on the 1st of July 2008 and made no further deposits. On the 1st of July 2018, the balance of Raj's account was \$13 857.
If interest was compounded annually, calculate the annual rate of compound interest paid on Raj's account? **2**

End of Question 14

Question 15 (15 marks) **Start a new writing booklet.**

(a) Graph the solution of $4x \leq 15 \leq -9x$ on a number line. **2**

(b)



A particle is observed as it moves in a straight line in the period between $t = 0$ and $t = 10$. Its velocity v at time t is shown on the graph above.
Copy this graph into your writing booklet.

(i) On the time axis, mark and clearly label with the letter ***X*** the times when the acceleration of the particle is zero. **2**

(ii) On the time axis, mark and clearly label with the letter ***H*** the time when the acceleration is greatest. **1**

(iii) There are three occasions when the particle is at rest, i.e. $t = 0, t = 7$, and $t = 10$. The particle is furthest from its initial position on one of these occasions. Indicate which occasion, giving reasons for your answer. **2**

(c) Consider the function $y = \ln(x - 2)$ for $x > 2$.

(i) Sketch the function, showing its essential features. **2**

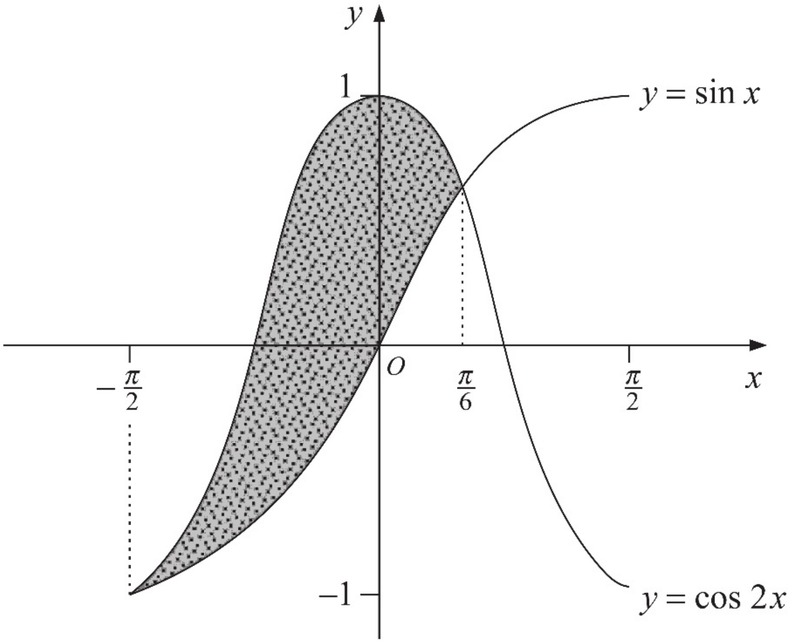
(ii) Use Simpson's Rule with three function values to find an approximation to **2**

$$\int_{3}^{5} \ln(x - 2)\, dx$$

Question 15 continues on the next page

(d) The diagram below shows the graphs of the functions $y = \cos 2x$ and $y = \sin x$ between $x = -\frac{\pi}{2}$ and $x = \frac{\pi}{2}$. The two graphs intersect at $x = \frac{\pi}{6}$ and $x = -\frac{\pi}{2}$. **4**

Calculate the area of the shaded region.



End of Question 15

Question 16 (15 marks) **Start a new writing booklet.**

(a) A particle is moving along the *x* axis. Its position at time *t* is given by

$$x = t + \sin t$$

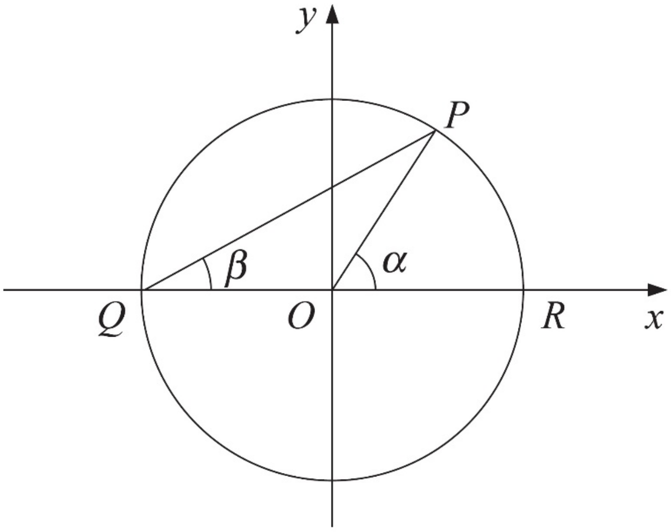
(i) At what times during the period $0 < t < 3\pi$ is the particle stationary? **2**

(ii) At what times during the period $0 < t < 3\pi$ is the acceleration equal to 0? **2**

(iii) Carefully sketch the graph of $x = t + \sin t$ for $0 < t < 3\pi$. **3**

Clearly label any stationary points and any points of inflexion.

(b)



In the diagram, Q is the point $(-1, 0)$, R is the point $(1, 0)$, and P is another point on the circle with centre *O* and radius 1. Let $\angle POR = \alpha$ and $\angle PQR = \beta$, and let $\tan\beta = m$.

(i) Given that $\triangle\, OPQ$ is isosceles, explain why $\alpha = 2\beta$. **1**

(ii) Find the equation of the line *PQ*. **1**

(iii) Show that the *x*-coordinates of *P* and *Q* are solutions of the equation **2**

$$(1 + m^2)x^2 + 2m^2x + m^2 - 1 = 0$$

(iv) Using this equation, find the coordinates of *P* in terms of *m*. **2**

(v) Hence deduce that $\tan 2\beta = \frac{2\tan\beta}{1-\tan^2\beta}$ **2**

End of Question 16

End of paper

Examination: TRIAL HSC.

Level: 2unit

Year: 2018

QUESTION: 11

1(a) $\frac{1}{22} = 0.0455$ ①

(b) $= \frac{2x}{6} + \frac{9x-3}{6}$ ①

$= \frac{11x-3}{6}$ ①

(c)(i) $\log_a\left(\frac{b}{c}\right) = \log_a b - \log_a c$

$= 2.75 - 0.25$

$= 2.50$ ①

(ii) $\log_a(bc)^2 = 2\log_a(bc)$

$= 2(\log_a b + \log_a c)$ ①

$= 2(3)$

$= 6$ ①

(d) $5 - 3x < 7$

$-3x < 2$

$x > -2/3$ ②

(e) let $y = (3x^2+4)^5$

$\frac{dy}{dx} = 5 \times (6x) \times (3x^2+4)^4$ ①

$= 30x(3x^2+4)^4$

(f)(i) $\int \sec^2 6x \, dx = \frac{1}{6}\tan 6x + c$ ①

(ii) $\int_1^{e^3} \frac{5}{x} dx = \left[5\ln x\right]_1^{e^3}$ ① $= 5(\ln e^3 - \ln 1)$

$= 5 \times 3 - 0$

$= 15$ ①

(g)(i) $\alpha + \beta = -4 \quad \alpha\beta = 1$ ①

(ii) $\frac{\alpha^2+\beta^2}{\alpha^2\beta^2} = \frac{(\alpha+\beta)^2 - 2\alpha\beta}{(\alpha\beta)^2}$ ① $= \frac{16-2}{1} = 14$ ①

Markers Comments

badly done

*If students got "9" as an answer they scored zero marks

* students who wrote $x < -2/3$ scored ① mark

Examination: Trials 2018

Level: 2 Unit Maths

Year: 12

1/2

QUESTION: 12

⑫

a) i) $a = 30 \quad \ell = 50 \quad S_n = 1240$

$S_n = \frac{n}{2}(30+50)$

$1240 = \frac{n}{2}(80)$

$1240 = 40n$

$n = \frac{1240}{40} = 31 \quad \therefore$ 31 bars //

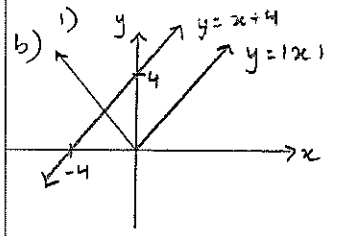
ii) $T_{31} = 30 + (31-1)d = 50$

$30 + 30d = 50$

$30d = 20$

$d = \frac{2}{3} \quad \therefore$ 2/3 cm. //

b) i)



ii) Two cases: $y = x$ and $y = -x$

① $y = x, \; y = x+4$

$x = x+4$

$0 = 4$

$\therefore$ no solution

② $y = -x, \; y = x+4$

$-x = x+4$

$-2x = 4$

$x = -2$

$y = 2 \quad \therefore (-2, 2)$

Markers Comments

Some students swapped the 30 and 50 to get $d = -2/3$

Done pretty well ✓

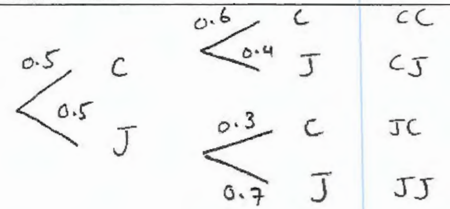
Done mostly well ✓

Examination: Trials 2018

Level: 2 Unit Maths

Year: 12

2/2

QUESTION: 12	Markers Comments
c) 1) 	Done well ✓.
ii) $P\{CJ\} + P\{JC\}$ $= (0.5\times0.4) + (0.5\times0.3) = 0.35$ //	✓
d) i) Since radius is 0.45m and $XY = XO = YO = 0.45m$ $\because$ XYO is an equilateral triangle $\therefore \angle XOY = \pi/3$ //	✓
ii) Area of major sector XOY $= \frac{300}{360}(\pi \times 0.45^2) \approx 0.530 m^2$ Area of triangle XOY $= \frac{1}{2}(0.45)^2 \times \sin(\pi/3) \approx 0.088 m^2$ $\therefore$ Total area $= 0.530 + 0.088 = 0.618 m^2$ OR Total circle area $= \pi \times 0.45^2 \approx 0.636$ Area of minor segment $= \frac{1}{2}(0.45)^2(\frac{\pi}{3} - \sin\frac{\pi}{3})$ ≈ 0.018 $\therefore$ Total area $= 0.636 - 0.018 = 0.618 m^2$	Students made mistakes with choosing the correct formula. Some used incomplete 'area of minor segment' formula. Algebra mistakes were common.

Examination: Year 12 Mathematics Trial HSC

Level: Year 12

Year: 2018

QUESTION: 13	Markers Comments
13a) $f'(x) = 3x^2 - 2$ $f(x) = \int 3x^2 - 2\, dx$ $= \frac{3x^3}{3} - 2x + C$ Sub (1, 3) into $x^3 - 2x + C$ $3 = 1^3 - 2 + C$ $\therefore C = 3 + 2 - 1$ $= 4$ $f(x) = x^3 - 2x + 4$	• Students made silly errors when finding C. • Some students differentiated instead of integrating • Overall, most students gained full marks.
b) (i) $0.85 \times 0.85 = 0.7225$ $\therefore 72.25\%$	• need to show working out to gain 1 mark.
(ii) $0.85^n \leq 0.1$ $\log 0.85^n \leq \log 0.1$ $n \log 0.85 \leq \log 0.1$ $n \geq \frac{\log 0.1}{\log 0.85}$ ≥ 14.168 $\therefore$ 15 layers required	• Some students used trial & error, which is also accepted as long substantial working out is shown.

Examination: Year 12 Mathematics Trial HSC
Level: yr 12
Year: 2018

QUESTION: 13	Markers Comments
c) $V = \pi \int_0^{10} x^2 \, dy$ $= \pi \int_0^{10} \left(\frac{y^2}{30}\right)^2 dy$ $= \frac{\pi}{900} \int_0^{10} y^4 \, dy$ $= \frac{\pi}{900} \left[\frac{y^5}{5} \right]_0^{10}$ $= \frac{\pi}{4500} (10\,000 - 0)$ $= \frac{200}{9} \pi$ or $= 22\frac{2}{9}$ or $= 69.8 \text{ cm}^3$ or 69.8 mL	• This question was poorly answred as some students had forgotten the formula when volume is rotated about y-axis. Many used $V = \pi \int_a^b y^2 dx$ • poor notation • 10cm implied the volume would be cm^3, many students just used $units^3$. Although it was not penalised, but advised to use appropriate units.

Examination: Year 12 Mathematics Trial HSC
Level: yr 12
Year: 2018

QUESTION: 13	Markers Comments
d)(i) Solve simultaneously to find intesection: $y = x + 2$ $y = x^2 - 5x + 11$ $x + 2 = x^2 - 5x + 11$ $0 = x^2 - 6x + 9$ $0 = (x-3)^2$ $\therefore x = 3$ Only one intersection point $y = x + 2$ must be tangent.	• Alot of silly errors when simplifying equation. • Some students used $\Delta = 0$ to show that there was only 1 solution, that was also awarded 2 marks. • Marks was penalised when students showed lack of understanding that 1 intersection point meant the line is a tangent.

Examination: Year 12 Mathematics Trial HSC .

Level: yr 12

Year: 2018

QUESTION: 13	Markers Comments
(d) (ii) $y = x^2 - 5x + 11$ $\frac{dy}{dx} = 2x - 5$ when $x = 3$, $\frac{dy}{dx} = 1$ $\therefore m_N = -1$ $(3,5)$ $y - 5 = -1(x-3)$ $y - 5 = -x + 3$ $\therefore y = -x + 8$ (iii) $y = -x + 8$ $y = x^2 - 5x + 11$ $-x + 8 = x^2 - 5x + 11$ $0 = x^2 - 4x + 3$ $0 = (x-3)(x-1)$ $\therefore x = 1, 3$ $A = \int_1^3 (-x+8)\,dx - \int_1^3 (x^2 - 5x + 11)\,dx$ $= \int_1^3 (-x^2 + 4x - 3)\,dx$ $= \left[\frac{-x^3}{3} + 2x^2 - 3x \right]_1^3$ $= (-9 + 18 - 9) - (-\frac{1}{3} + 2 - 3)$ $= \frac{4}{3} = 1\frac{1}{3}$ square units	

Examination: 2018 TRIAL HSC MATHEMATICS

Level: 2 UNIT

Year: 2018 1/3

QUESTION: 14	Markers Comments
(a) i) $R = R_0 e^{-kt}$ when $t = 20$, $0.5 R_0 = R_0 e^{-20k}$ $\frac{1}{2} = e^{-20k}$ $\ln(\frac{1}{2}) = -20k$ $k = \frac{\ln(\frac{1}{2})}{-20}$	This question was done well.
ii) $0.3 R_0 = R_0 e^{-kt}$ $0.3 = e^{-kt}$ $e^{-kt} = 0.3$ $-kt = \ln(0.3)$ $t = \frac{\ln(0.3)}{-\left(\frac{\ln(\frac{1}{2})}{20}\right)}$ $t = 34$ years 9 months $34.7 - 20 = 14.7$ $\therefore$ 14 years and months more	} Most student did not answer this part.
(b) LHS $= \sec^2\theta - \tan^2\theta$ $= \frac{1}{\cos^2\theta} - \frac{\sin^2\theta}{\cos^2\theta}$ $= \frac{\cos^2\theta}{\cos^2\theta}$ $= 1$ $=$ RHS $\therefore$ LHS $=$ RHS.	Most Students did this well.

Examination: TRIAL HSC EXAM

Level: 2 Unit MATHEMATICS

Year: 2018

2/3

QUESTION: 14

Markers Comments

c)

DIE 1

DIE2

	1	2	3	4	5	6
1	2	3	4	5	6	⑦
2	3	4	5	6	⑦	8
3	4	5	6	⑦	8	⑨
4	5	6	⑦	8	⑨	10
5	6	⑦	8	⑨	10	11
6	⑦	8	⑨	10	11	12

$P(9) = \frac{4}{36} = \frac{1}{9}$

$P(\text{not a } 7 \text{ or } 9) = \frac{26}{36} = \frac{13}{18}$

This question was not well done.

(i) $P(\text{wins on first second or third roll})$

$= \frac{1}{9} + \frac{13}{18} \times \frac{1}{9} + \frac{13}{18} \times \frac{13}{18} \times \frac{1}{9}$

$= \frac{1}{9} + \frac{13}{18} \times \frac{1}{9} + \left(\frac{13}{18}\right)^2 \times \frac{1}{9}$

ii) $P(\text{wins the game}) = \frac{1}{9} + \frac{13}{18} \times \frac{1}{9} + \left(\frac{13}{18}\right)^2 \times \frac{1}{9} + \ldots$

limiting sum exists since $r = \frac{13}{18}$ where $|r| < 1$

$S_\infty = \frac{a}{1-r}$

$= \frac{\frac{1}{9}}{1 - \frac{13}{18}} = \frac{\frac{1}{9}}{\frac{5}{8}} = \frac{2}{5}$

} Most students realised a limiting sum exists but failed to state $|r| < 1$ for limiting sum.

Examination: TRIAL HSC

Level: 2 UNIT

Year: 2018

3/3

QUESTION: 14

Markers Comments

d) i) $n = 10, \ R = 0.032, \ P = 10\,000$

$A = 10000\,(1.032)^{10}$

$= 13 \cdot 41046$

$$\text{Amount} = 10\,000(1.032)^{10} + \underbrace{1000(1.032)^9 + 1000(1.032)^8 + \ldots + 1000(1.032) + 1000}_{S_{10}}.$$

} This que was not done well

$S_{10} = \frac{1(1.032)^{10} - 1}{1.032 - 1}$

$= \frac{0.37024104 63}{0.032}$

$= 11 \cdot 5700327$

$\text{Amount} = 10000(1.032)^{10} + 1000(11.5700327)$

$= 13\,702 \cdot 41046 + 11\,570.0327$

$= \$\,25\,272 \cdot 44$

ii) $10000(1+r)^{10} = 13857$

$(1+r)^{10} = 1.3857$

$1 + r = \sqrt[10]{1.3857}$

$r = \sqrt[10]{1.3857} - 1$

$= 1.033158425 - 1$

$r = 0.0315 8425$

$\therefore r = 3.3158\,\%$

Most students did this well.

Examination: Trial 2018

Level: 2 Unit Maths

Year: 12.

1/2

QUESTION: 15	Markers Comments

(a) $4x \le 15 \le -9x$

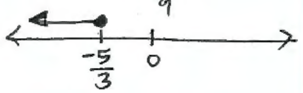
$4x \le 15$ | $15 \le -9x$

$x \le \frac{15}{4}$ | $\frac{15}{-9} \ge x$

$x \le -\frac{5}{3}$

$\therefore x \le -\frac{5}{3}$ or $-1\frac{2}{3}$

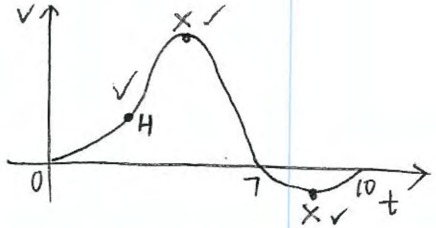
or $x \le -\frac{15}{9}$



(b)

(i)

(ii)



(iii) Between $t=0$ & $t=7$, the particle is moving away from its initial position because its velocity is positive. Between $t=7$ & $t=10$, the particle is moving towards its initial position because its velocity is negative.

$\therefore$ the particle is furthest from its initial position at $t=7$.

Examination: Trials 2018

Level: 2 Unith Maths

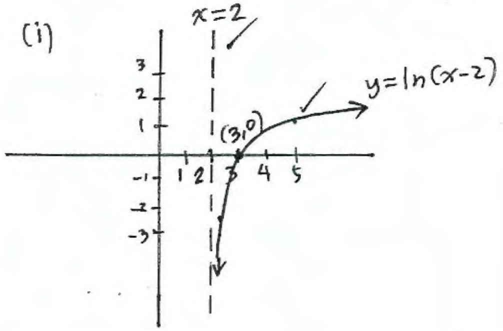
Year: 12.

2/2

QUESTION: 15	Markers Comments

(c) $y = \ln(x-2)$ for $x > 2$

(i)



(ii) ✓ $\int_3^5 \ln(x-2)\,dx = \frac{5-3}{6}\left[\ln 1 + 4\ln 2 + \ln 3\right]$

$= \frac{1}{3}\left[0 + 4\ln 2 + \ln 3\right]$

$= 1.29\ u^2$ ✓ or $\frac{\ln 48}{3}$

(d) Area $= \int_{-\frac{\pi}{2}}^{\frac{\pi}{6}} (\cos 2x - \sin x)\,dx$ ✓

$= \left[\frac{1}{2}\sin 2x + \cos x\right]_{-\frac{\pi}{2}}^{\frac{\pi}{6}}$ ✓

✓ $= \left[\frac{1}{2}\sin\frac{\pi}{3} + \cos\frac{\pi}{6}\right] - \left[\frac{1}{2}\sin(-\pi) + \cos\left(\frac{-\pi}{2}\right)\right]$

$= \left(\frac{1}{2}\cdot\frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2}\right) - (0+0)$

$=$ ✓ $\frac{3\sqrt{3}}{4}$ units^2 $\doteqdot 1.299$ units^2