Sydney Technical High School

Student Name FILE

Teacher's Name:

Extension 1 Mathematics

TRIAL HSC

August 2020

General Instructions

- Working time - 120 minutes + 10 minutes reading time
- Write using black pen
- NESA approved calculators may be used
- A reference sheet is provided at the back of this paper
- In questions 11-14, show relevant mathematical reasoning and/or calculations

Total marks: 70

Section I – 10 marks

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

Section II – 60 marks

- Attempt questions 11-14
- Allow about 1 hours and 45 minutes for this section

Section I

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

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

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1. A coin is biased such that the probability of a head is 0.8. The probability that exactly four tails will be observed when the coin is flipped ten times is:

(A) $10 \times 0.2^6 \times 0.8^4$

(B) ${}^{10}C_4 \times 0.2^4 \times 0.8^6$

(C) ${}^{10}C_4 \times 0.2^6 \times 0.8^4$

(D) $10 \times 0.2^4 \times 0.8^6$

2. Which one of the following vectors is parallel to the vector $\overrightarrow{OP} = 12\underset{\sim}{i} - 6\underset{\sim}{j}$?

(A) $\overrightarrow{OA} = 12\underset{\sim}{i} + 6\underset{\sim}{j}$

(B) $\overrightarrow{OB} = -\underset{\sim}{i} + 2\underset{\sim}{j}$

(C) $\overrightarrow{OC} = 2\underset{\sim}{i} + \underset{\sim}{j}$

(D) $\overrightarrow{OD} = -2\underset{\sim}{i} + \underset{\sim}{j}$

3. Which of the following is the correct expression for $\displaystyle\int \frac{dx}{\sqrt{9 - x^2}}$?

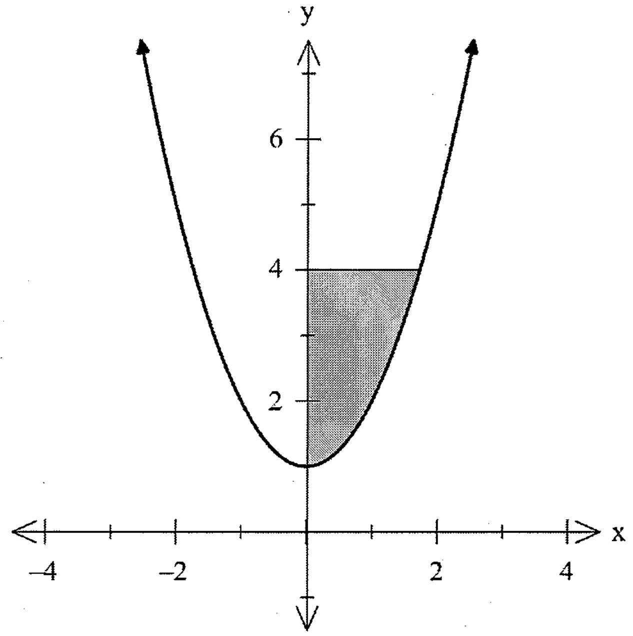
(A) $\sin^{-1} 3x + c$

(B) $\cos^{-1} 3x + c$

(C) $\sin^{-1} \frac{x}{3} + c$

(D) $\cos^{-1} \frac{x}{3} + c$

4. The region made between the curves $y = x^2 + 1$ and $y = 4$, and the y-axis is shown below.



Which of these expressions gives the area of the region shown?

(A) $\int_0^{\sqrt{3}} x^2 + 1\, dx$

(B) $\int_1^4 y - 1\, dy$

(C) $\pi \int_1^4 y - 1\, dy$

(D) $\int_1^4 \sqrt{y - 1}\, dy$

5. The number of elephants, N, in a population at time t is given by $N = Ae^{kt} + 750$, with constants $A > 0$ and $k > 0$. Which of the following is the correct differential equation?

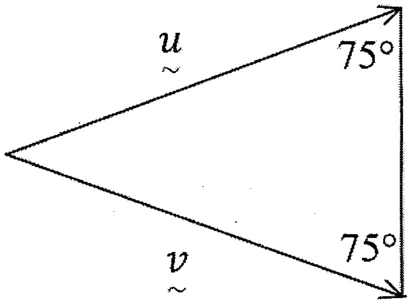
(A) $\frac{dN}{dt} = -k(N + 750)$

(B) $\frac{dN}{dt} = k(N + 750)$

(C) $\frac{dN}{dt} = -k(N - 750)$

(D) $\frac{dN}{dt} = k(N - 750)$

6. In the triangle below, $|\underset{\sim}{u}| = |\underset{\sim}{v}| = 4$.



What is the value of $\underset{\sim}{u} \cdot \underset{\sim}{v}$?

(A) 16

(B) $8\sqrt{2}$

(C) 8

(D) $8\sqrt{3}$

7. Which polynomial has a multiple root at $x = 1$

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

(B) $x^3 - 3x + 2$

(C) $x^3 - 3x - 4$

(D) $x^3 + 3x^2 + 2$

8. When $\cos x + \sin x$ is rewritten in the form $R\cos(x - \alpha)$, then:

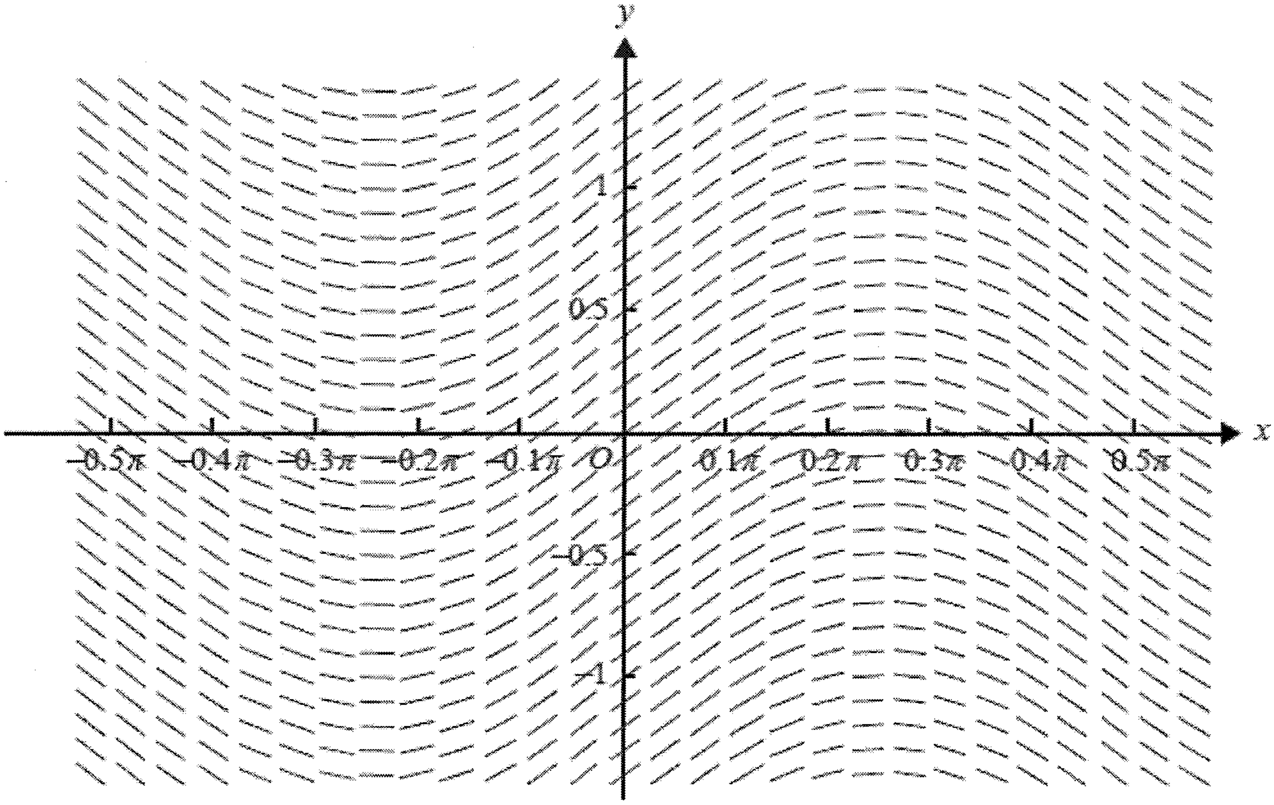
(A) $R = \sqrt{2}$ and $\alpha = \frac{\pi}{4}$

(B) $R = 2$ and $\alpha = \frac{\pi}{4}$

(C) $R = \sqrt{2}$ and $\alpha = \frac{3\pi}{4}$

(D) $R = 2$ and $\alpha = \frac{3\pi}{4}$

9. The slope field below is for a first-order differential equation.



Which of the following is a possible differential equation?

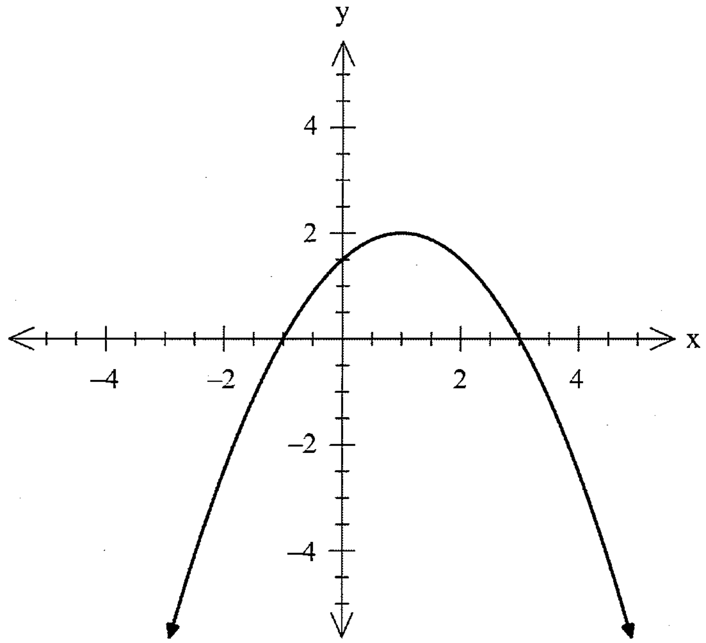
(A) $\frac{dy}{dx} = \sin 2x$

(B) $\frac{dy}{dx} = \sin 2y$

(C) $\frac{dy}{dx} = \cos 2x$

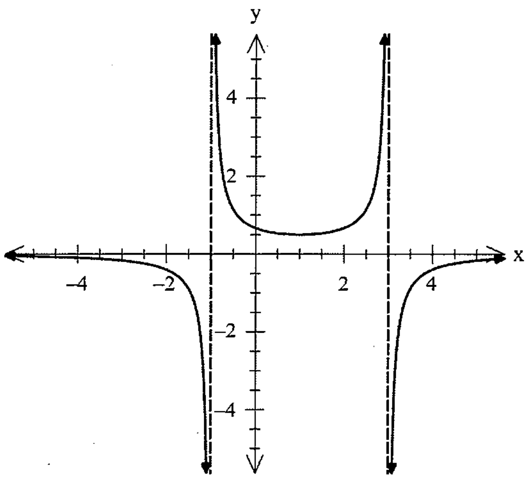
(D) $\frac{dy}{dx} = \cos 2y$

10. The graph of the function $y = f(x)$ is below.

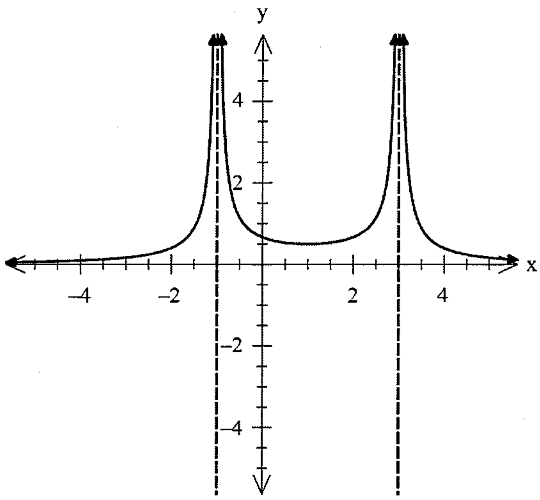


Which of the following is a graph of $y = \frac{1}{|f(x)|}$?

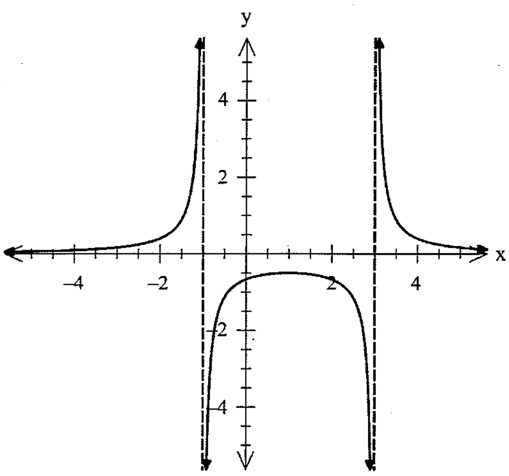
(A)



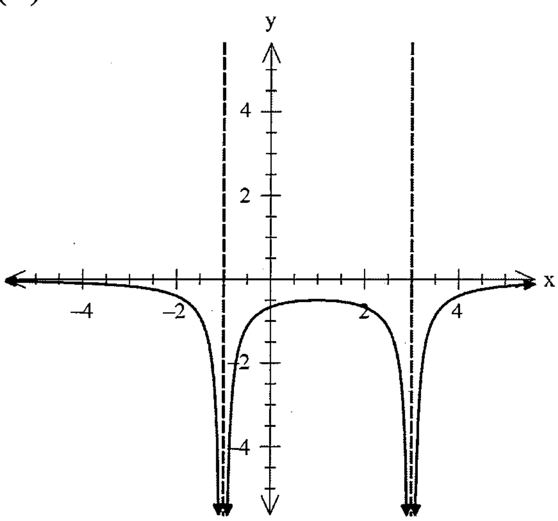
(B)



(C)



(D)



Section II

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

Begin each question on a NEW page

In Questions 11-14, your responses should include relevant mathematical reasoning and/or calculations.

Question 11 (15 marks) Begin a NEW page.

a) Nine people are arranged around a circular table

i. How many ways can they be arranged? **1**

ii. If they are seated randomly, what is the probability that two individuals, Lois and Clark, are sitting next to each other? **1**

b) The heights in a population are normally distributed with a mean of 173 cm and a standard deviation of 7cm. Use the empirical rule to find the approximate probability that a randomly selected person has a height under 159 cm? **2**

c) A standard die is rolled 5 times. What is the probability of rolling a four at least two times? **2**

d) Find $\frac{dy}{dx}$ if $y = e^{2x}\cos^{-1}x$ **2**

e) Find $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$ if $x = 2\cos t$ and $y = 2\sin t$ **2**

f) Solve $\frac{2x}{x-3} \geq x + 4$ **3**

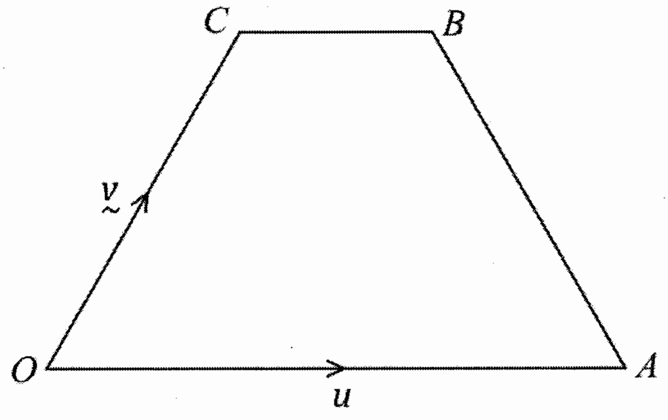
g) Use the substitution $u = 2 - x^4$, or otherwise, to find $\int 7x^3(2 - x^4)^5 \; dx$ **2**

End of Question 11

Question 12 (15 marks) Begin a NEW page.

a) Find the particular solution to $\frac{dy}{dx} = \frac{2x}{3y^2}$ where $y(0) = 1$ **3**

b) In the trapezium below, $\overrightarrow{OA} = \underset{\sim}{u}$, $\overrightarrow{OC} = \underset{\sim}{v}$, and $|\overrightarrow{OA}| = 2|\overrightarrow{CB}|$ **2**



(Not to scale)

Express the vector $\overrightarrow{BA}$ in terms of $\underset{\sim}{u}$ and $\underset{\sim}{v}$.

c) An unbiased coin is flipped 6400 times. The random variable X is the number of heads recorded.

i. Assuming that X can be accurately approximated by a normal distribution, find the values of μ and σ such that $X \sim N(\mu, \sigma^2)$ **1**

ii. Find the z-scores of flipping 3260 heads and of flipping 3100 heads. **2**

iii. Hence, use the table below to estimate the probability of flipping between 3 100 and 3 260 heads. **2**

	First Decimal Place									
z	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0	0.5000	0.5398	0.5793	0.6179	0.6554	0.6915	0.7257	0.7580	0.7881	0.8159
1	0.8413	0.8643	0.8849	0.9032	0.9192	0.9332	0.9452	0.9554	0.9641	0.9713
2	0.9772	0.9821	0.9861	0.9893	0.9918	0.9938	0.9953	0.9965	0.9974	0.9981
3	0.9987	0.9990	0.9993	0.9995	0.9997	0.9998	0.9998	0.9999	0.9999	1.0000

Question 12 is continued on the next page

d) If $t = \tan\frac{\theta}{2}$

i. Show that $3\sin\theta - 4\cos\theta - 4 = \frac{6t-8}{1+t^2}$ **2**

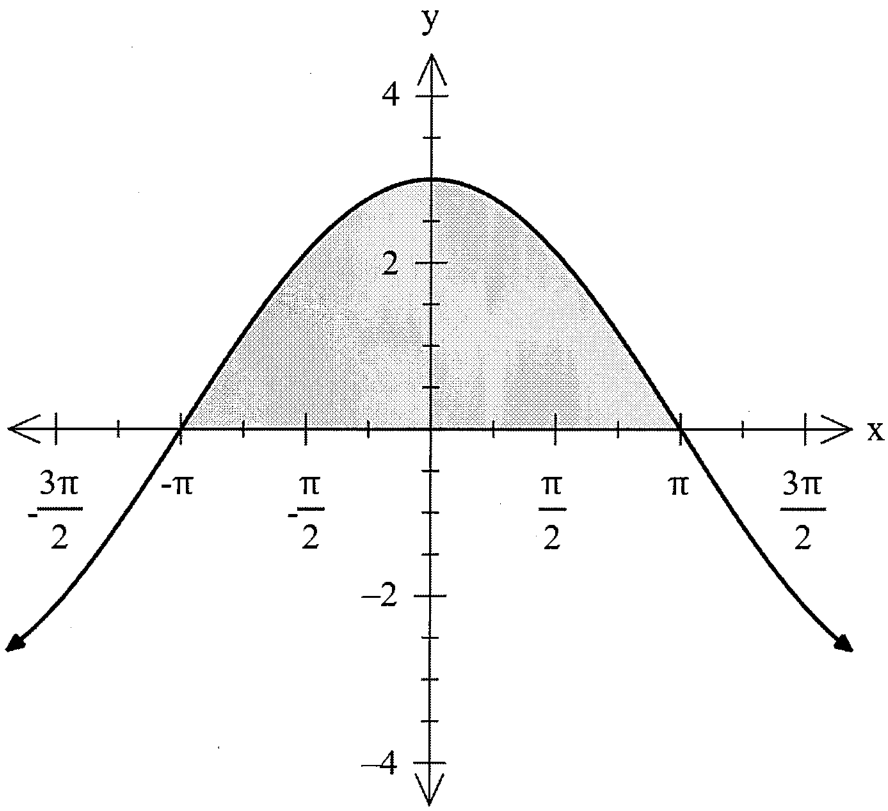
ii. Hence solve $3\sin\theta - 4\cos\theta = 4$ for $0 \leq \theta \leq 2\pi$ **3**

End of Question 12

Question 13 (15 marks) Begin a NEW page.

a) The radius of the base of a cylinder is increasing at a rate of 5 cm/min. The height of the cylinder is fixed at 30 cm and the formula for the volume of a cylinder is $V = \pi r^2 h$. Find the exact rate of change of the volume of the cylinder at the instant where the radius is 10 cm. **2**

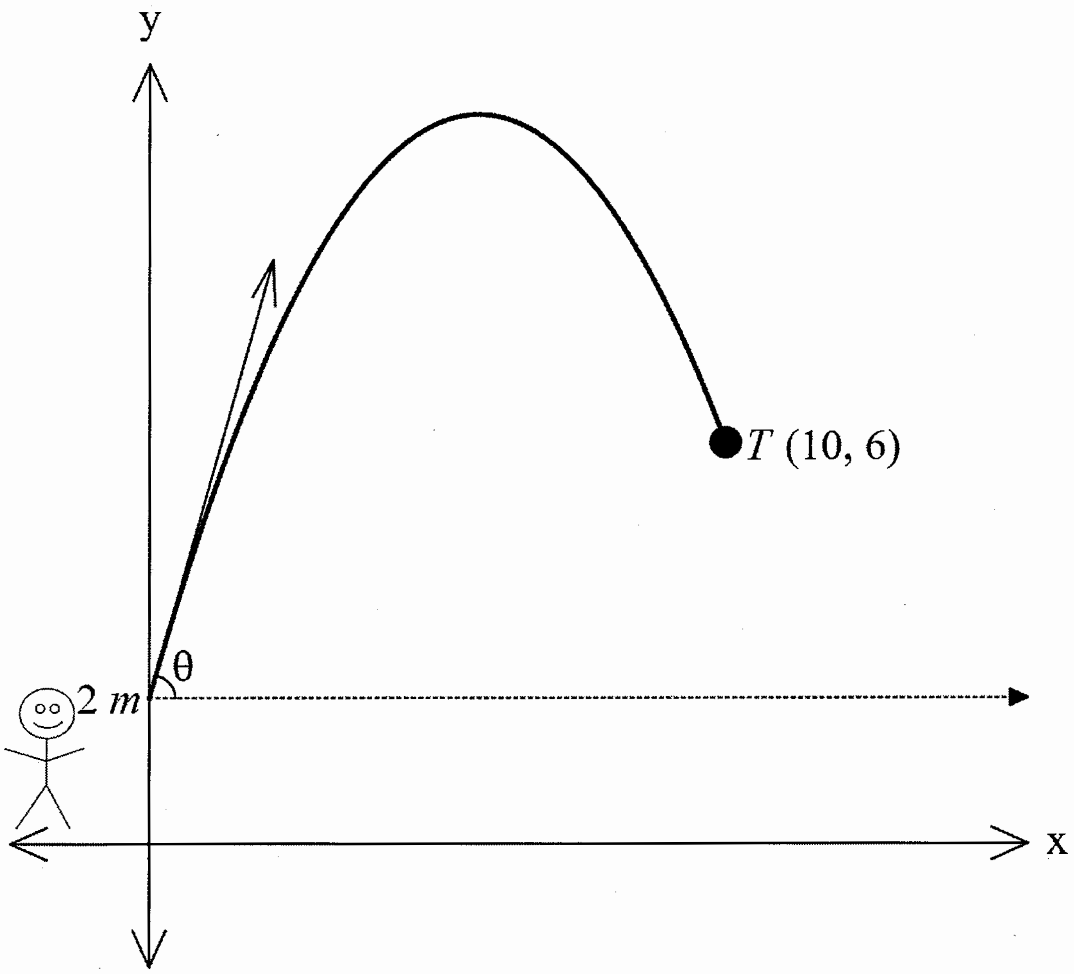
b) Below, the region between $y = 3\cos\frac{x}{2}$ and the x-axis is shaded between $x = -\pi$ and $x = \pi$.



If the region is rotated around the x-axis, find the volume of the solid formed. Leave your answer to 2 decimal places. **3**

c) Use mathematical induction to prove that $7^{2n} + 7^n + 4$ is divisible by 6 for integers $n \geq 0$. **4**

d) Billy throws a pebble from a height of 2 metres at an angle of θ to the horizontal, with a velocity of 30m/s.



i. Show that the expressions for the horizontal and vertical displacement at t seconds after projection are $x = 30t\cos\theta$ and $y = -5t^2 + 30t\sin\theta + 2$ respectively. (Take the acceleration due to gravity as -10 m/s^2 and take the origin to be the ground directly below Billy). **2**

ii. Show that the equation of the path of the particle is **2**

$y = \frac{-x^2}{180}(1 + \tan^2\theta) + x\tan\theta + 2$

iii. If Billy manages to hit a target at point T, which is 10 away on the ground and 6 metres high, find two possible angles of projection, to the nearest degree. **2**

End of Question 13

Question 14 (15 marks) Begin a NEW page.

a) 25 quokkas are introduced to an island to promote the survival of the species. The growth of their population, Q, over t years, can be modelled by $\frac{dQ}{dt} = 0.0006Q(15\,000 - Q)$.

i. Show that $\frac{1}{0.0006Q(15\,000-Q)} = \frac{1}{9}\left(\frac{1}{Q} + \frac{1}{15\,000-Q}\right)$ **1**

ii. Hence, solve $\frac{dQ}{dt} = 0.0006Q(15\,000 - Q)$, using integration, to show that $Q = \frac{15\,000}{1+Be^{-9t}}$, where B is some constant. **3**

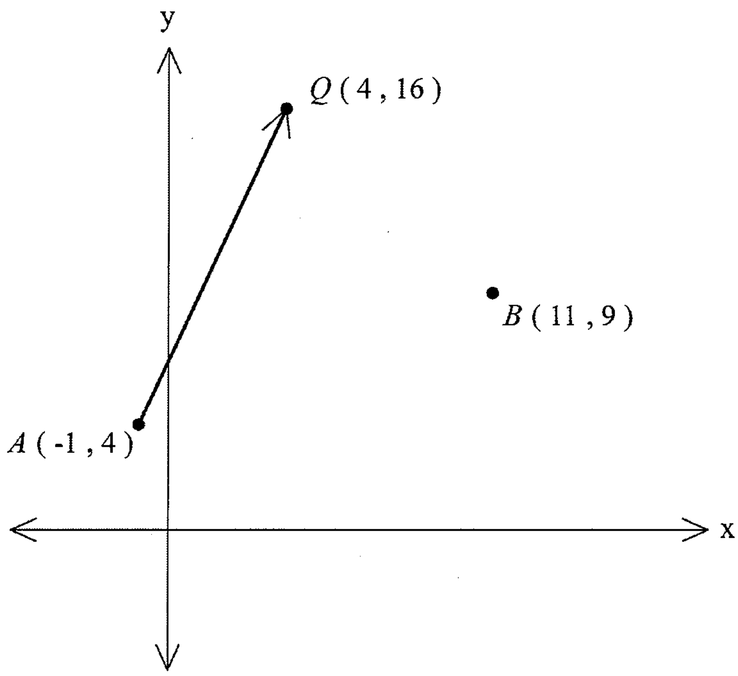
iii. Find the value of B, and hence use the model to estimate the number of quokkas on the island after two months. **2**

iv. What is the maximum number of quokkas that the island will support? **1**

v. After how many months is the number of quokkas to greater than half of the maximum amount? **2**

Question 14 is continued on the next page

b) Adam walks in a straight line form the point $A(-1, 4)$ to the point $Q(4, 16)$ with constant speed. His position vector can be expressed in the form $\underset{\sim}{p} = \underset{\sim}{a} + t\underset{\sim}{u}$, where t is the time after he starts walking. Adam arrives at the point Q at $t = 3$.



i. State the vectors $\underset{\sim}{a}$ and $\underset{\sim}{u}$. **2**

ii. Bob is at point $B(11,9)$. During Adam's walk from A to P, Bob wishes to throw a ball to Adam. Bob decides to throw the ball when Adam is at the closest point to B.

α) Write a vector $\underset{\sim}{w}$ that is perpendicular to $\underset{\sim}{u}$. **1**

β) Hence or otherwise, find value of t when Bob throws the ball to Adam. **3**

End of Exam

Ex Trial Solutions

MC

1. B

2. D

3. C

4. D

5. D

6. D

7. B

8. A

9. C

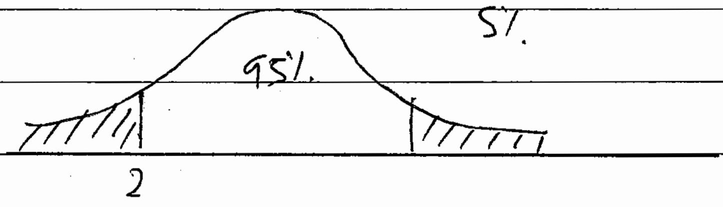
10. B

11.

a) i/ $8! = 40320$

ii/ $\dfrac{1\times 2\times 7!}{40320} = \dfrac{1}{4}$

b) $159 = 173 - 2\times 7$



$P(X<159) = \dfrac{5\%}{2} = 2.5\%$

c) $P(\text{At least two}) = 1 - \left({}^5C_0\left(\frac{5}{6}\right)^5 + {}^5C_1\times\left(\frac{1}{6}\right)\times\left(\frac{5}{6}\right)^4\right)$

$= \dfrac{763}{3888}$

d) $u = e^{2x}$ $\quad v = \cos^{-1}x$

$u' = 2e^{2x}$ $\quad v' = -\dfrac{1}{\sqrt{1-x^2}}$

$\therefore \dfrac{dy}{dx} = 2e^{2x}\cos^{-1}x - \dfrac{e^{2x}}{\sqrt{1-x^2}}$

e) $\dfrac{dx}{dt} = -2\sin t$ $\quad \dfrac{dy}{dt} = 2\cos t$

$\therefore \dfrac{dy}{dx} = \dfrac{-2\sin t}{2\cos t} = -\tan t$

At $t = \frac{\pi}{4}$, $\dfrac{dy}{dx} = -\tan\frac{\pi}{4}$

$= -1$

f) $\frac{2x}{x-3} \times (x-3)^2 \geq (x+4)(x-3)^2 \qquad x \neq 3$

$2x(x-3) \geq (x+4)(x-3)^2 \geq 0$

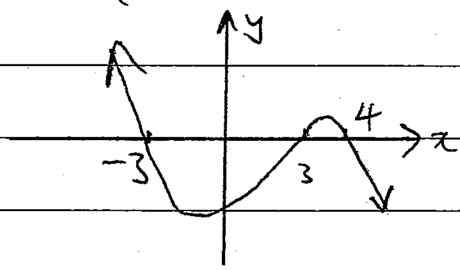
$(x-3)[2x - (x+4)(x-3)] \geq 0$

$(x-3)(2x - (x^2+x-12)) \geq 0$

$(x-3)(-x^2+x+12) \geq 0$

$-(x-3)(x^2-x-12) \geq 0$

$-(x-3)(x-4)(x+3) \geq 0$



$\therefore\ x \leq -3, \quad 3 < x \leq 4$

g) $u = 2 - x^4$

$du = -4x^3\,dx$ and $dx = \frac{du}{-4x^3}$

$\therefore \int 7x^3 (2-x^4)^5\,dx$

$= 7\int x^3 u^5 \times \frac{du}{-4x^3}$

$= \frac{-7}{4} \int u^5\,du$

$= \frac{-7}{4} \times \frac{u^6}{6} + c$

$= \frac{-7(2-x^4)^6}{24} + C$

12.

a) $\frac{dy}{dx} = \frac{2x}{3y^2}$

$\int 3y^2\, dy = \int 2x\, dx$

$y^3 = x^2 + c$

At $x=0$, $y=1$

$1 = 0 + c$

$c = 1$

So $y^3 = x^2 + 1$

$y = \sqrt[3]{x^2+1}$

b) $\overrightarrow{BA} = \frac{1}{2}\underset{\sim}{u} - \underset{\sim}{v} + \underset{\sim}{u}$

$= \frac{1}{2}\underset{\sim}{u} - \underset{\sim}{v}$

c) i/ $\mu = 6400 \times \frac{1}{2}$

$= 3200$

$\sigma^2 = 6400 \times \frac{1}{2} \times \frac{1}{2}$

$\sigma^2 = 1600$

$\sigma = 40$

ii/ For 3260

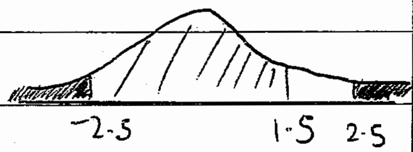
$z = \frac{3260 - 3200}{40} = 1.5$

For 3100

$z = \frac{3100 - 3200}{40} = -2.5$

iii/ $P(3100 \leq X \leq 3260)$

$= P(-2.5 \leq Z \leq 1.5)$



$= P(Z \leq 1.5) - P(Z \geq 2.5)$

$= P(Z \leq 1.5) - (1 - P(Z \leq 2.5))$

$= 0.9332 - 1 + 0.9938$

$= 0.927$

d) i/ $LHS = 3\sin\theta - 4\cos\theta - 4$

$$= \frac{3\times 2t}{1+t^2} - \frac{4(1-t^2)}{1+t^2} - \frac{4(1+t^2)}{1+t^2}$$

$$= \frac{6t - 4 + 4t^2 - 4 - 4t^2}{1+t^2}$$

$$= \frac{6t-8}{1+t^2}$$

ii/ $3\sin\theta - 4\cos\theta = 4$

$$3\sin\theta - 4\cos\theta - 4 = 0$$

Hence $\frac{6t-8}{1+t^2} = 0$ from i/

$$t = \frac{4}{3}$$

$\therefore \tan\frac{\theta}{2} = \frac{4}{3}$ $\quad 0 \leq \theta \leq 2\pi$

$\frac{\theta}{2} = 0.927...$ $\quad 0 \leq \frac{\theta}{2} \leq \pi$

$\theta = 1.85$ (2dp)

Check: If $\theta = \pi$ $\quad LHS = 3\sin\pi - 4\cos\pi$

$= 4$

$= RHS$

$\therefore \theta = 1.85$ (2dp), π

13

a) $\frac{dr}{dt} = 5$ $\qquad V = \pi r^2 \times 30$

$\frac{dV}{dr} = 60\pi r$

Now $\frac{dV}{dt} = \frac{dr}{dt} \times \frac{dV}{dr}$

$= 5 \times 60\pi r = 300\pi r$

At $r = 10$

$\frac{dV}{dt} = 3000\pi$

b) $V = 2\pi \int_0^{\pi} \left(3\cos\frac{x}{2}\right)^2 dx$ $\qquad \cos x = 2\cos^2\frac{x}{2} - 1$, $\cos^2\frac{x}{2} = \frac{1}{2}(1+\cos x)$

$= 18\pi \int_0^{\pi} \cos^2\frac{x}{2}\, dx$

$= 9\pi \int_0^{\pi} 1 + \cos x \, dx$

$= 9\pi \left[x + \sin x \right]_0^{\pi}$

$= 9\pi(\pi + \sin\pi - (0 + \sin 0))$

$= 9\pi^2 \; u^3$

$= 88.83 \; (2dp) \; u^3$

c) Show true for $n=0$

$7^0+7^0+4=6$, which is divisible by 6

$\therefore$ Statement is true for $n=1$.

Assume true for $n=k$, i.e. assume

$7^{2k}+7^k+4=6M$, where M is an integer

$\therefore 7^k=6M-4-7^{2k}$

Hence prove true for $n=k+1$, i.e aim to prove

$7^{2(k+1)}+7^{k+1}+4$ is divisible by 6.

$=7^{2k+2}+7^{k+1}+4$

$=49\times7^{2k}+7\times7^k+4$

$=49\times7^{2k}+7(6M-4-7^{2k})+4$, by assumption.

$=49\times7^{2k}+42M-28-7\times7^{2k}+4$

$=42\times7^{2k}+42M-24$

$=6(7\times7^{2k}+7M-4)$

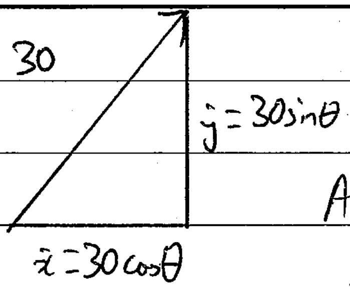
$=6L$, where L is an integer.

$\therefore$ If the statement is true for $n=k$, it is also true for $n=k+1$.

As the statement is true for $n=0$, it is also true for $n=1+1=2,3,4\ldots$

Hence, by mathematical induction, it is true for all integers $n\geq0$

d) i/ $\ddot{x} = 0$



$\dot{x} = c_1$

At $t = 0$, $\dot{x} = 3\cos\theta$

$\therefore c_1 = 30\cos\theta$

So $\dot{x} = 30\cos\theta$

$x = 30t\cos\theta + c_2$

At $t = 0$, $x = 0$

$\therefore c_2 = 0$

So $x = 30t\cos\theta$

$\ddot{y} = -10$

$\dot{y} = -10t + c_3$

At $t = 0$, $\dot{y} = 30\sin\theta$

$\therefore c_3 = 30\sin\theta$

So $\dot{y} = -10t + 30\sin\theta$

$y = -5t^2 + 30t\sin\theta + c_4$

At $t = 0$, $y = 2$

$\therefore c_4 = 2$

So $y = -5t^2 + 30t\sin\theta + 2$

ii/

So $t = \dfrac{x}{30\cos\theta}$ — (1) and $y = -5t^2 + 30t\sin\theta + 2$ — (2)

Sub (1) into (2)

$$y = -5\left(\frac{x}{30\cos\theta}\right)^2 + 30\sin\theta \times \frac{x}{30\cos\theta} + 2$$

$$= \frac{-5}{30^2}x^2\sec^2\theta + x\tan\theta + 2$$

$$= \frac{-x^2}{180}(1 + \tan^2\theta) + x\tan\theta + 2$$

At $x=6$, $y=10$

$$6 = \frac{-10^2}{180}\left(1+\tan^2\theta\right) + 10\tan\theta + 2$$

$$6 = \frac{-5}{9}\left(1+\tan^2\theta\right) + 10\tan\theta + 2$$

$$54 = -5 - 5\tan^2\theta + 90\tan\theta + 18$$

$$5\tan^2\theta - 90\tan\theta + 41 = 0$$

$$\tan^2\theta = \frac{90 \pm \sqrt{90^2 - 4\times5\times41}}{2\times5}$$

$$= \frac{90 \pm \sqrt{7280}}{10}$$

$$\therefore \tan\theta = \frac{90+\sqrt{7280}}{10}, \quad \tan\theta = \frac{90-\sqrt{7280}}{10}$$

(Note: θ is acute).

$$\therefore \theta = 87^\circ, 25^\circ$$

14.

a)

$$\text{RHS} = \frac{1}{9}\left(\frac{1}{Q} + \frac{1}{15000-Q}\right)$$

$$= \frac{1}{9}\left(\frac{15000 - Q + Q}{Q(15000-Q)}\right)$$

$$= \frac{15000}{9}\left(\frac{1}{Q(15000-Q)}\right)$$

$$= \frac{1}{\frac{9}{15000}Q(15000-Q)}$$

$$= \frac{1}{0.0006Q(15000-Q)}$$

$$= \text{LHS}$$

ii/ Hence $\dfrac{dt}{dQ} = \dfrac{1}{0.0006Q(15000-Q)}$

$$\frac{dt}{dQ} = \frac{1}{9}\left(\frac{1}{Q} + \frac{1}{15000-Q}\right)$$

$$t = \frac{1}{9}\left(\int \frac{1}{Q}\,dQ - \int \frac{-1}{15000-Q}\,dQ\right)$$

$$t = \frac{1}{9} \ln|Q| - \ln|15000-Q| + c$$

$$9(t-c) = \ln\left|\frac{Q}{15000-Q}\right|$$

$$\therefore \left|\frac{Q}{15000-Q}\right| = e^{9t-9c}$$

$$\frac{Q}{15000-Q} = Ae^{9t}, \quad \text{where } A = \pm e^{-9c}$$

$$Q = 15000Ae^{9t} - QAe^{9t}$$

$$Q(1 + Ae^{9t}) = 15000Ae^{9t}$$

$$Q = \frac{15000Ae^{9t}}{1+Ae^{9t}}$$

$$Q = \frac{15000}{\frac{1}{Ae^{9t}} + 1}$$

$$Q = \frac{15000}{1+Be^{-9t}}, \quad \text{where } B = \frac{1}{A}$$

iii/ At $t=0$, $Q=25$

$$25 = \frac{15000}{1+Be^{-9\times 0}}$$

$$25+25B=15000$$

$$25B=14975$$

$$B=599$$

$\therefore$ At $t=\frac{2}{12}$ (t is in years)

$$Q=\frac{15000}{1+599e^{-9\times\frac{2}{12}}}$$

$$=111\cdot395$$

$\therefore$ Estimate of 111 quokkas after 2 months.

iv/ Carrying capacity as $t\to\infty$

$$\therefore Q \to \frac{15000}{1+0} = 15000$$

$\therefore$ The maximum number supported is 15000.

v/ Hence, set $Q = 7500$

$$7500 = \frac{15000}{1+599e^{-9t}}$$

$$1+599e^{-9t} = 2$$

$$e^{-9t} = \frac{1}{599}$$

$$-9t = \ln\left(\frac{1}{599}\right)$$

$$t = -\frac{1}{9}\ln\left(\frac{1}{599}\right)$$

$$= 0.71\ldots \text{ years}$$

$$= 8.527\ldots \text{ months.}$$

$\therefore$ After 9 months the amount of quokkas exceeds half of the maximum.

b) i/ $\overrightarrow{AQ} = \begin{bmatrix} 4-(-1) \\ 16-4 \end{bmatrix} = \begin{bmatrix} 5 \\ 12 \end{bmatrix}$

and Adam gets to Q from A at $t=3$,

Hence $\underset{\sim}{a} = \begin{bmatrix} -1 \\ 4 \end{bmatrix}$ and $\underset{\sim}{u} = \frac{1}{3} \times \begin{bmatrix} 5 \\ 12 \end{bmatrix}$

$= \begin{bmatrix} \frac{5}{3} \\ 4 \end{bmatrix}$

ii/ α) A vector perpendicular is

$\underset{\sim}{w} = \begin{bmatrix} -4 \\ \frac{5}{3} \end{bmatrix}$ or any scalar multiple.

β) Equation of the throw β: $\begin{bmatrix} 11 \\ 9 \end{bmatrix} + \lambda \begin{bmatrix} -4 \\ \frac{5}{3} \end{bmatrix}$,

as it goes from $(11, 9)$ in the direction $\underset{\sim}{w}$.

Hence $\begin{bmatrix} -1 \\ 4 \end{bmatrix} + t \begin{bmatrix} \frac{5}{3} \\ 4 \end{bmatrix} = \begin{bmatrix} 11 \\ 9 \end{bmatrix} + \lambda \begin{bmatrix} -4 \\ \frac{5}{3} \end{bmatrix}$

$$\begin{bmatrix} -1 + \frac{5t}{3} \\ 4 + 4t \end{bmatrix} = \begin{bmatrix} 11 - 4\lambda \\ 9 + \frac{5\lambda}{3} \end{bmatrix}$$

$\therefore -1 + \frac{5t}{3} = 11 - 4\lambda$ and $4 + 4t = 9 + \frac{5\lambda}{3}$

$-3 + 5t = 33 - 12\lambda$

$12\lambda = 36 - 5t$ $\qquad$ $12 + 12t = 27 + 5\lambda$ — (2)

$\lambda = \frac{36-5t}{12}$ — (1)

Sub (1) into (2)

$$12 + 12t = 27 + 5 \times \frac{36-5t}{12}$$

$$-15 + 12t = \frac{5(36-5t)}{12}$$

$$-180 + 144t = 180 - 25t$$

$$169t = 360$$

$t = \frac{360}{169}$ (or $t = 2.13$ (2dp))