# Year 2009
# VCE
# Mathematical Methods
# Solutions
# Trial Examination 2



| | |
|---|---|
| **KILBAHA MULTIMEDIA PUBLISHING** | **TEL: (03) 9817 5374** |
| **PO BOX 2227** | **FAX: (03) 9817 4334** |
| **KEW VIC 3101** | **kilbaha@gmail.com** |
| **AUSTRALIA** | **http://kilbaha.googlepages.com** |

**SECTION 1**

# ANSWERS

| | | | | | |
|---|---|---|---|---|---|
| 1 | A | B | C | **D** | E |
| 2 | **A** | B | C | D | E |
| 3 | A | **B** | C | D | E |
| 4 | A | B | C | D | **E** |
| 5 | A | B | **C** | D | E |
| 6 | **A** | B | C | D | E |
| 7 | A | **B** | C | D | E |
| 8 | A | B | **C** | D | E |
| 9 | **A** | B | C | D | E |
| 10 | A | **B** | C | D | E |
| 11 | A | B | C | D | **E** |
| 12 | A | B | **C** | D | E |
| 13 | A | B | C | **D** | E |
| 14 | A | B | C | **D** | E |
| 15 | A | B | C | D | **E** |
| 16 | A | B | C | **D** | E |
| 17 | A | **B** | C | D | E |
| 18 | A | **B** | C | D | E |
| 19 | A | B | **C** | D | E |
| 20 | A | B | C | **D** | E |
| 21 | **A** | B | C | D | E |
| 22 | A | B | C | D | **E** |

**SECTION 1**

**Question 1** **Answer D**

$f(x) = g(x)\log_e(2x)$ differentiating using the product rule

$f'(x) = g'(x)\log_e(2x) + \frac{g(x)}{x}$

$f'\left(\frac{e}{2}\right) = g'\left(\frac{e}{2}\right)\log_e(e) + \frac{2}{e}g\left(\frac{e}{2}\right)$

$f'\left(\frac{e}{2}\right) = 1 \times 1 + \frac{e}{2} \times \frac{2}{e} = 2$

**Question 2** **Answer A**

$f(x) = \sin\left(\frac{1}{x}\right)$

Let $y = \sin(u)$ $u = \frac{1}{x} = x^{-1}$ chain rule

$\frac{dy}{du} = \cos(u)$ $\frac{du}{dx} = -x^{-2} = -\frac{1}{x^2}$

$\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx} = -\frac{1}{x^2}\cos\left(\frac{1}{x}\right)$

$f'(a) = -\frac{1}{a^2}\cos\left(\frac{1}{a}\right)$

**Question 3** **Answer B**

$f(x) = x^3 + e^{2x}$ now $f(2) = 8 + e^4$ $f(0) = 1$

average rate is $\frac{f(2) - f(0)}{2 - 0} = \frac{8 + e^4 - 1}{2} = \frac{7 + e^4}{2}$

**Question 4** **Answer E**

All of **A. B. C.** and **D.** are true, **E.** is false although $\int_0^{\frac{2\pi}{n}} (a + b\sin(nx))\,dx = \frac{2\pi a}{n}$

This will only be the area if $a > |b|$ and $a > 0$.

**Question 5** **Answer C**

Let $y_1 = mx + c$ and $y_2 = -x^2 + 3x - 3$, the tangent to the graph at the point *P*, where $x = 3$. $\frac{dy_2}{dx} = -2x + 3$ $\left.\frac{dy_2}{dx}\right|_{x=3} = -3 = m$ so **B.** is true.

At $x = 3$ $y_2 = -9 + 9 - 3 = -3$ $P(3, -3)$ is on the tangent,

$y_1 = mx + c \Rightarrow -3 = -9 + c \Rightarrow c = 6$ so **A**. is true, also **D.** is true.

The area $A = \int_a^b (y_1 - y_2)\,dx$ $a = 0$ $b = 3$, so that $A = \int_0^3 \left(x^2 + (m-3)x + (c+3)\right)dx$

**E.** is true, **C.** is false.

**Question 6** **Answer A**

$f(x+h) \approx f(x) + hf'(x)$ with $f(x) = \frac{1}{x^2}$ $x = 4$ $h = -0.01$

so that $\frac{1}{3.99} \approx f(4) - 0.01 f'(4)$

**Question 7** **Answer B**

The required area is below the *x*-axis, so taking the absolute value, makes the area positive. **A.** is true $\left|\int_{-a}^{a}\left(x^2 - a^2\right)dx\right|$ this is also equal to **D.** which is true $\int_{-a}^{a}\left(a^2 - x^2\right)dx$ ,

by symmetry **C.** is true $2\int_0^a\left(a^2 - x^2\right)dx$. The graph of $y = x^2 - a^2$, this crosses the *y*-axis at $-a^2$, now the inverse function is $x = y^2 - a^2 \Rightarrow y^2 = x + a^2 \Rightarrow y = \sqrt{x + a^2}$, the area bounded by the curve and the *y*-axis is $2\left|\int_{-a^2}^{0}\sqrt{x + a^2}\,dx\right|$, so that **E.** is true, **B.** is false.

**Question 8** **Answer C**

$f: \quad y = x^2 + a \qquad \text{dom } f = R^- \quad \text{ran } f = (a, \infty)$

$f^{-1} \quad x = y^2 + a$ transposing

$y^2 = x - a \quad y = \pm\sqrt{x - a}$ but ran $f^{-1} = R^-$ dom $f^{-1} = (a, \infty)$ so we must take the negative, $f^{-1} : (a, \infty) \to R$, $f^{-1}(x) = -\sqrt{x - a}$

**Question 9** **Answer A**

$f(x) = f(-x)$ , $f(x)$ is an even function, and $\int_{-6}^{6} f(x)\,dx = 10$ , then $\int_{0}^{6} f(x)\,dx = 5$

$\int_{0}^{6}\left(2f(x)-1\right)dx = 2\int_{0}^{6} f(x)\,dx - \left[x\right]_0^6 = 2\text{x}5 - (6-0) = 4$

**Question 10** **Answer B**

The function is not defined when $x = 0$,
all of **A, C, D.** and **E.** are false,
The function is an even function,
symmetrical about the *y*-axis.

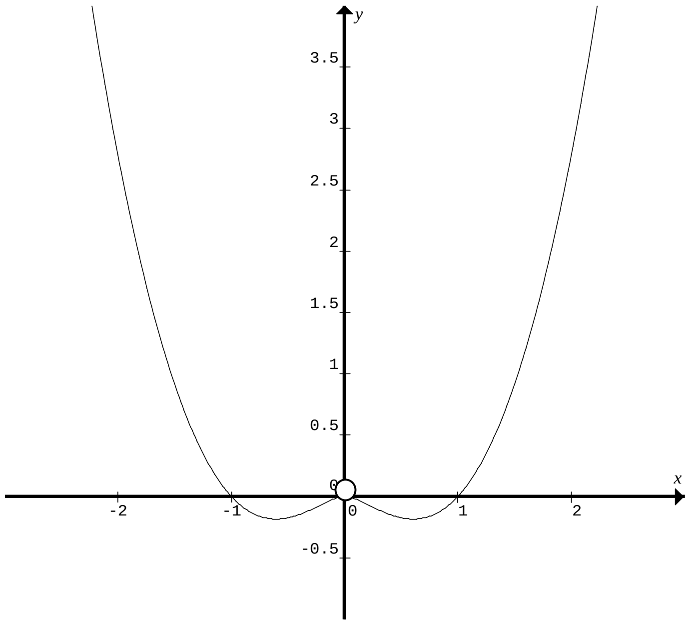
$y = x^2 \log_e(x)$

$\frac{dy}{dx} = 2x\log_e(x) + x = x\left(2\log_e(x)+1\right)$

for turning points, $\frac{dy}{dx} = 0$, since $x \neq 0$

$\log_e(x) = -\frac{1}{2}$ $\quad x = e^{-\frac{1}{2}} = \frac{1}{\sqrt{e}}$,

the graph has minimums at $x = \pm\frac{1}{\sqrt{e}}$




**Question 11** **Answer E**

$f: \quad y = b + \frac{a}{x-b}$

$f^{-1} \quad x = b + \frac{a}{y-b} \qquad \Rightarrow x - b = \frac{a}{y-b} \qquad \Rightarrow y - b = \frac{a}{x-b}$

$f^{-1}(x) = y = b + \frac{a}{x-b}$ so $f^{-1} = f$

The domain and range of both $f$ and $f^{-1}$ are $R\backslash\{b\}$.

Since $a \neq 0$ and $b \neq 0$, the graph of $y = f(x)$ passes through $\left(0,\, b - \frac{a}{b}\right)$

and the graph of $y = f^{-1}(x)$ passes through $\left(b - \frac{a}{b}, 0\right)$.

All of **A. B. C. D.** are true, however **E.** is false
The graph of $y = f(x)$ and $y = f^{-1}(x)$ always intersects on the line $y = x$ at the points $\left(b \pm \sqrt{a}, b \pm \sqrt{a}\right)$ only if $a > 0$.

**Question 12** **Answer C**

$\frac{dy}{dx} = 2\cos\left(\frac{x}{2}\right) \quad \Rightarrow \quad y = \int 2\cos\left(\frac{x}{2}\right)dx = 4\sin\left(\frac{x}{2}\right) + c$ to find *c*, use $y\left(\frac{5\pi}{3}\right) = 0$

$0 = 4\sin\left(\frac{5\pi}{6}\right) + c = 2 + c = 0 \quad \Rightarrow c = -2$

$y = 4\sin\left(\frac{x}{2}\right) - 2$ now when $x = 0$ $y = 4\sin(0) - 2 = -2$

**Question 13** **Answer D**

$y = \frac{bx}{x-a} = \frac{bx - ab + ab}{x-a} = b + \frac{ab}{x-a}$ has $y = b$ as a horizontal asymptote and $x = a$ as a vertical asymptote.

**Question 14** **Answer D**

Let $f : [0, \pi] \to R$ , $f(x) = 2\cos\left(\frac{x}{2}\right) - 2$. The period is $T = \frac{2\pi}{\frac{1}{2}} = 4\pi$

The graph of $f$ is transformed by a reflection in the *x*-axis, the rule is

$g(x) = 2 - 2\cos\left(\frac{x}{2}\right)$, we only have one-quarter of a cycle

now a dilation of factor 2 from the *y*-axis, replace $x$ with $\frac{x}{2}$

$g : [0, 2\pi] \to R$ , $g(x) = 2 - 2\cos\left(\frac{x}{4}\right)$ since we must have one-quarter of a cycle,

the new domain is $[0, 2\pi]$

then a dilation by a factor of 3 from the *x*-axis, multiply *y* by 3

the equation becomes $g : [0, 2\pi] \to R$ , $g(x) = 6 - 6\cos\left(\frac{x}{4}\right)$

**Question 15** **Answer E**

$\Pr(A' \cap B') + b - p = 1 - a$ or

$\Pr(A' \cap B') + a - p = 1 - b$

$\Pr(A' \cap B') = 1 + p - (a + b)$

| | $A$ | $A'$ | |
|---|---|---|---|
| $B$ | $p$ | $b - p$ | $b$ |
| $B'$ | $a - p$ | ? | $1 - b$ |
| | $a$ | $1 - a$ | |

**Question 16** **Answer D**

$f(x) = x^4 - 4x^2$

$f'(x) = 4x^3 - 8x$

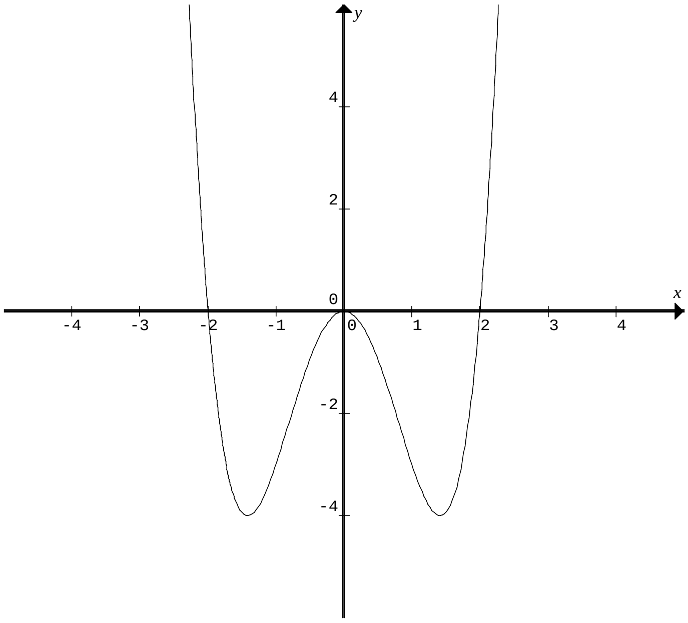
$f'(x) = 4x(x^2 - 2)$

turning points at

$x = 0$, $x = \pm\sqrt{2}$

for the function to be one-one, we require

$a < -\sqrt{2}$




**Question 17** **Answer B**

$X \overset{d}{=} Bi(n = ?, p = 0.6)$ Betty winning a game.

$\Pr(X = 0) = 0.4^n \le 0.01$

$n \log_e(0.4) \le \log_e(0.01)$

$n \ge \dfrac{\log_e(0.01)}{\log_e(0.4)} = 5.02$ so $n = 6$

**Question 18** **Answer B**

$X \overset{d}{=} N\left( \mu_X = \mu, \sigma_X^2 = \dfrac{9\mu^2}{4} \right)$

$\Pr(X > 2\mu) = \Pr\left( Z > \dfrac{2\mu - \mu}{\frac{3}{2}\mu} \right) = \Pr\left( Z > \dfrac{2}{3} \right) = 0.252$

**Question 19** **Answer C**

Let $g(x) = \int_0^x f(t)\,dt$ then $g'(x) = f(x)$

$g(0) = 0$ $g'(0) = f(0) = 9$ $g'(3) = f(3) = 0$

**Question 20** **Answer D**

Option **D.** has $f(x)=e^{x}$ $g(x)=-x^{2}$ and $f(g(x))=e^{-x^{2}}$
Which is the graph required.

**Question 21** **Answer A**

$A=\frac{3\sqrt{3}}{2}L^{2}$ $\frac{dA}{dL}=3\sqrt{3}L$ given $\frac{dL}{dt}=\sqrt{3}$ cm/s

$\frac{dA}{dt}=\frac{dA}{dL}.\frac{dL}{dt}=3\sqrt{3}\,L\times\sqrt{3}=9L$

$\left.\frac{dA}{dt}\right|_{L=\sqrt{3}}=9\sqrt{3}$ cm$^{2}$/s

**Question 22** **Answer E**

Since $\sum \Pr(X=x)=1 \Rightarrow \frac{a}{2}+a+b+\frac{b}{2}=\frac{3a}{2}+\frac{3b}{2}=1 \Rightarrow 3(a+b)=2$ **A.** is true

$E(X)=\sum x\Pr(X=x)=-2\times\frac{a}{2}-a+b+2\times\frac{b}{2}=-2a+2b=2(b-a)$ **B.** is true

$E(X^{2})=\sum x^{2}\Pr(X=x)=(-2)^{2}\times\frac{a}{2}+(-1)^{2}a+(1)^{2}b+(2)^{2}\times\frac{b}{2}=2a+a+b+2b=3(a+b)=2$

**C.** is true, since **A.** is true.

$\text{var}(X)=E(X^{2})-(E(X))^{2}=2-4(b-a)^{2}=2-4b^{2}+8ab-4a^{2}$ **D.** is true

**E.** is false, $E\left(\frac{1}{X}\right)=\sum\frac{1}{x}\Pr(X=x)=-\frac{a}{4}-a+b+\frac{b}{4}=\frac{5}{4}(b-a)$

**END OF SECTION 1 SUGGESTED ANSWERS**

**SECTION 2**

**Question 1**

**a.i** $f(x)=x^3-3x^2+cx+d$

$f'(x)=3x^2-6x+c$

but $x=-1$ is a turning point so $f'(x)=(x+1)(3x-9)=3(x+1)(x-3)$

Expanding gives $c=-9$ ,

also $u=3$, A1

$f(-1)=5=-1-3-c+d=-4+9+d$ so that

$d=0$ A1

$f(3)=v=27-27-27=-27$

$v=-27$ A1

**ii.** The graph of $y=x^3-3x^2-9x$ has a maximum value of 5, and a minimum value of $-27$, and crosses the *x*-axis at three distinct points. The graph of $y=x^3-3x^2-9x+d$ will therefore cross the *x*-axis at three distinct points, provided that $d\in(-5,27)$ or $-5<d<27$ A2

**b.** $f(x)=x^3-3x^2+cx+d$

$f'(x)=3x^2-6x+c$ **,** for two distinct turning points, we require

$\Delta=36-12c>0$ M1

$c<3$ and $d\in R$ A1

**c.** $f(x+p)=(x+p)^3-3(x+p)^2+c(x+p)+d$

$f(x+p)=x^3+3x^2p+3xp^2+p^3-3\left(x^2+2xp+p^2\right)+cx+cp+d$

$f(x+p)=x^3+x^2(3p-3)+x\left(3p^2-6p+c\right)+p^3-3p^2+cp+d=x^3$

therefore $3p-3=0 \quad \Rightarrow p=1$ A1

and $3p^2-6p+c=0$ since $p=1$ $c=6-3=3$

$c=3$ A1

and $p^3-3p^2+cp+d=0$

so $d=-1$ A1

alternative method, if $y=(x-1)^3=x^3-3x^2+3x-1 \ \rightarrow y=x^3$

so that $p=1$ $c=3$ and $d=-1$

**d.** $A=\int_a^b f(x)\,dx \quad a=0 \quad b=2 \quad h=\frac{1}{2} \quad n=4 \quad f(x)=x^3-3x^2+cx+d$

$(1) \quad L=10=h\left[f(0)+f\left(\frac{1}{2}\right)+f(1)+f\left(\frac{3}{2}\right)\right]$ M1

$(2) \quad R=6=h\left[f\left(\frac{1}{2}\right)+f(1)+f\left(\frac{3}{2}\right)+f(2)\right]$

$(1)\Rightarrow \quad 20=f(0)+f\left(\frac{1}{2}\right)+f(1)+f\left(\frac{3}{2}\right)$

$(2)\Rightarrow \quad 12=f\left(\frac{1}{2}\right)+f(1)+f\left(\frac{3}{2}\right)+f(2)$ subtracting gives M1

$8=f(0)-f(2)=d-(8-12+2c+d)=4-2c$

$2c=-4$

$c=-2$ A1

**Question 2**

**a.** the amplitude is 1.5, so that $a=1.5$

one-half cycle is 8, so that $T=\frac{2\pi}{n}=16 \quad \Rightarrow n=\frac{\pi}{8}$ A1

**b.** $y=16\left(1-e^{-kx}\right)$ passes through the origin $O(0,0)$ and $B(4,8)$

$8=16\left(1-e^{-4k}\right) \quad \Rightarrow \quad \frac{1}{2}=1-e^{-4k}$

$e^{-4k}=\frac{1}{2} \qquad e^{4k}=2$ M1

$4k=\log_e(2)$

$k=\frac{1}{4}\log_e(2)$

**c.i** reflect in the *y*-axis
translate 8 units, to the right, away from the *y*-axis A1
or translate 8 units, to the right parallel to the *x*-axis.

**ii.** $f:[4,8]\to R\ ,\ f(x)=16\left(1-e^{k(x-8)}\right)$ A2

must give domain.

**d.i** $A=2\int_0^4\left(16\left(1-e^{-kx}\right)-\frac{3}{2}\sin\left(\frac{\pi x}{8}\right)\right)dx$ A1

**ii.** $A=2\left[16x+\frac{16}{k}e^{-kx}+\frac{12}{\pi}\cos\left(\frac{\pi x}{8}\right)\right]_0^4$ each term A1

$A=2\left[\left(64+\frac{16}{k}e^{-4k}+\frac{12}{\pi}\cos\left(\frac{\pi}{2}\right)\right)-\left(0+\frac{16}{k}+\frac{12}{\pi}\cos(0)\right)\right]$ but $e^{-4k}=\frac{1}{2}$ M1

$A=2\left[64+\frac{8}{k}-\frac{16}{k}-\frac{12}{\pi}\right]$

$A=128-\frac{16}{k}-\frac{24}{\pi}$ A2

$p=128\quad q=-16$ and $r=-24$

**Question 3**

**a.** the function is continuous $f(4)=16b=4c \quad\Rightarrow\quad c=4b$ M1

the total area under the curve is one.

$b\int_0^4 t^2\,dt+c\int_4^8(8-t)\,dt=1$

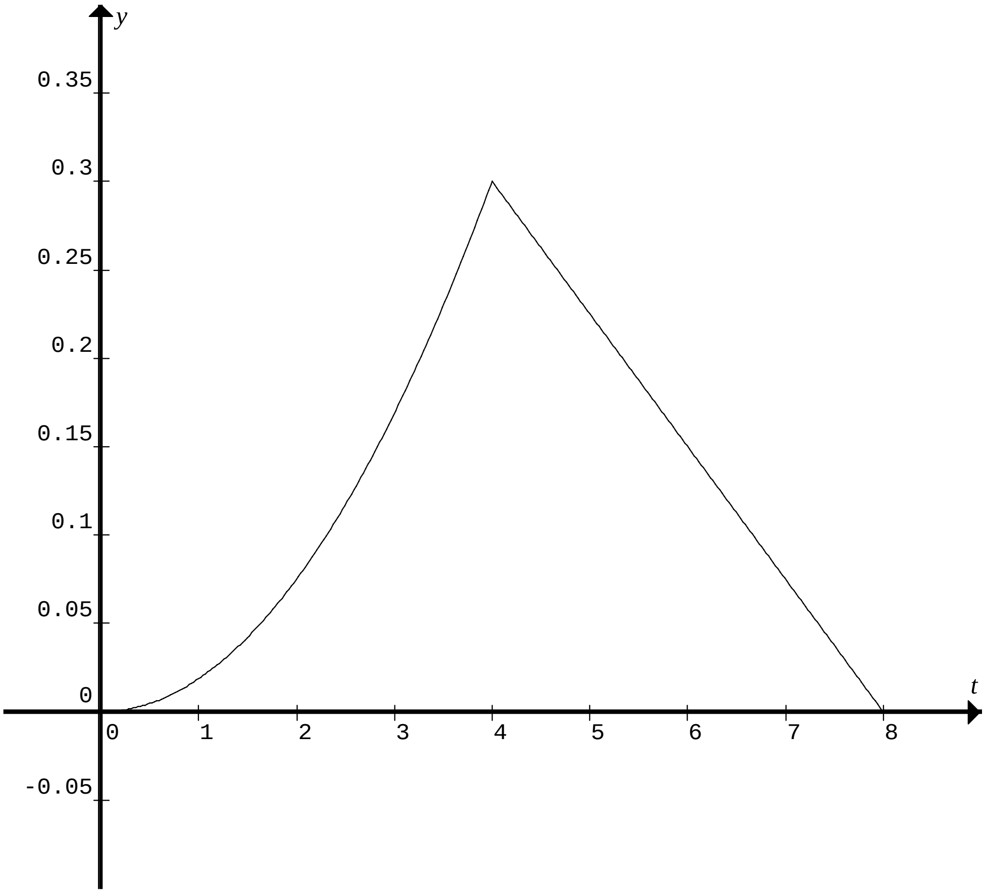
$b\left[\frac{1}{3}t^3\right]_0^4+c\left[8t-\frac{1}{2}t^2\right]_4^8=1$ A1

$b\left(\frac{1}{3}(64-0)\right)+c\left((64-32)-(32-8)\right)=1$

$\frac{64b}{3}+8c=1$ but $c=4b$

$b\left(\frac{64}{3}+32\right)=1 \qquad\Rightarrow\ b=\frac{3}{160}$ and $c=\frac{3}{40}$ A1

**b.** must show point at $(4, 0.3)$ and zero for $t \geq 8$ and $t \leq 0$ G1




**c.** $\Pr(T > 6) = \frac{3}{40}\int_6^8 (8-t)\,dt$ or the area of a triangle as M1

$\Pr(T > 6) = \frac{1}{2} \times 2 \times 2c = \frac{3}{20}$

$\Pr(T > 6) = \frac{3}{20}$ A1

**d.** $E(T) = \frac{3}{160}\int_0^4 t^3\,dt + \frac{3}{40}\int_4^8 t(8-t)\,dt$ M1

$E(T) = 1.2 + 3.2 = 4.4$ minutes A1

**e.** Since $\frac{3}{160}\int_0^4 t^2\,dt = 0.4$ the median time $m$ is given by

$\frac{3}{40}\int_4^m (8-t)\,dt = 0.1$ A1

$\left[8t - \frac{1}{2}t^2\right]_4^m = \frac{4}{3}$

$\left(8m - \frac{m^2}{2}\right) - (32-8) = \frac{4}{3}$ M1

$m^2 - 16m + \frac{152}{3} = 0$ solving for $m$, and $4 < m < 8$

$m = 4.35$ minutes A1

**f.** $X$ is the running time of the movie in minutes

$X \stackrel{d}{=} N\left(\mu = 94, \sigma^2 = 10^2\right)$

$\Pr(X > 109) = \Pr\left(Z > \frac{109-94}{10}\right) = \Pr(Z > 1.5)$

$= 0.0668$ A1

**g.** $Y \stackrel{d}{=} Bi(n = 4, p = 0.0668)$

$\Pr(Y \geq 2) = 1 - \left[\Pr(Y = 0) + \Pr(Y = 1)\right]$

$\Pr(Y \geq 2) = 1 - \left[0.9332^4 + {}^4C_1\, 0.0668 \text{x} 0.9332^3\right]$ M1

$\Pr(Y \geq 2) = 0.0244$ A1

**h.** $\Pr(2 \text{ comedies}) = ACC + CAC + CCA$ M1

$= 0.45 \text{ x } 0.55 \text{ x } 0.65 + 0.55 \text{ x } 0.35 \text{ x } 0.55 + 0.55 \text{ x } 0.65 \text{ x } 0.35$

$= 0.392$ A1

**Question 4**

**a.** $P\left(a, \dfrac{4}{a^2}\right) \quad O(0,0)$

$s = d(OP) = \sqrt{(a-0)^2 + \left(\dfrac{4}{a^2} - 0\right)^2}$ M1

$s = \sqrt{a^2 + \dfrac{16}{a^4}} = \sqrt{\dfrac{16+a^6}{a^4}}$ since $a > 0$

$s = \dfrac{1}{a^2}\sqrt{16+a^6}$ A1

**b.i.** $\dfrac{ds}{da} = \dfrac{\dfrac{1}{2} \text{ x } 6a^5 \text{ x } \dfrac{1}{\sqrt{16+a^6}} \text{ x } a^2 - 2a\sqrt{16+a^6}}{a^4}$ differentiating using the quotient rule

$\dfrac{ds}{da} = \dfrac{1}{a^4}\left[\dfrac{3a^7 - 2a\left(16+a^6\right)}{\sqrt{16+a^6}}\right]$ M1

$\dfrac{ds}{da} = 0$ for minimum distance

$\dfrac{ds}{da} = \dfrac{a^6 - 32}{a^3\sqrt{16+a^6}} = 0$ A1

$a = \sqrt[6]{32} = 2^{\frac{5}{6}}$ A1

**ii.** $S_{\min} = \sqrt[3]{2}.\sqrt{3} \approx 2.182$ A1

**c.i** at the point $P\left(a, \dfrac{4}{a^2}\right)$ $f'(x) = -8x^{-3}$ $m_T = -\dfrac{8}{a^3}$ A1

$m_N = \dfrac{a^3}{8}$

normal $y - \dfrac{4}{a^2} = \dfrac{a^3}{8}(x-a)$ or $y = \dfrac{a^3x}{8} - \dfrac{a^4}{8} + \dfrac{4}{a^2}$ A1

**ii.** normal passes through origin $(0,0)$ then

$-\dfrac{a^4}{8} + \dfrac{4}{a^2} = 0$

$a^6 = 32$ A1

$a = \sqrt[6]{32} = 2^{\frac{5}{6}}$

**Question 5**

$f:[0,2\pi]\to R\ ,\quad f(x)=\sqrt{3}\sin(2x)+\cos(2x)$

**a.** $f(x)=0$

$\sqrt{3}\sin(2x)+\cos(2x)=0$

$\sqrt{3}\sin(2x)=-\cos(2x)$

$\tan(2x)=-\frac{1}{\sqrt{3}}$ M1

$2x=-\frac{\pi}{6}\ ,\ -\frac{\pi}{6}+\pi,\ -\frac{\pi}{6}+2\pi,\ -\frac{\pi}{6}+3\pi,\ -\frac{\pi}{6}+4\pi$

$2x=\frac{5\pi}{6},\frac{11\pi}{6},\frac{17\pi}{6}\ ,\ \frac{23\pi}{6}$

$x=\frac{5\pi}{12},\frac{11\pi}{12},\frac{17\pi}{12}\ ,\ \frac{23\pi}{12}$ A1

**b.i.** $f'(x)=2\sqrt{3}\cos(2x)-2\sin(2x)=0$ A1

$\sqrt{3}\cos(2x)=\sin(2x)$

$\tan(2x)=\sqrt{3}$

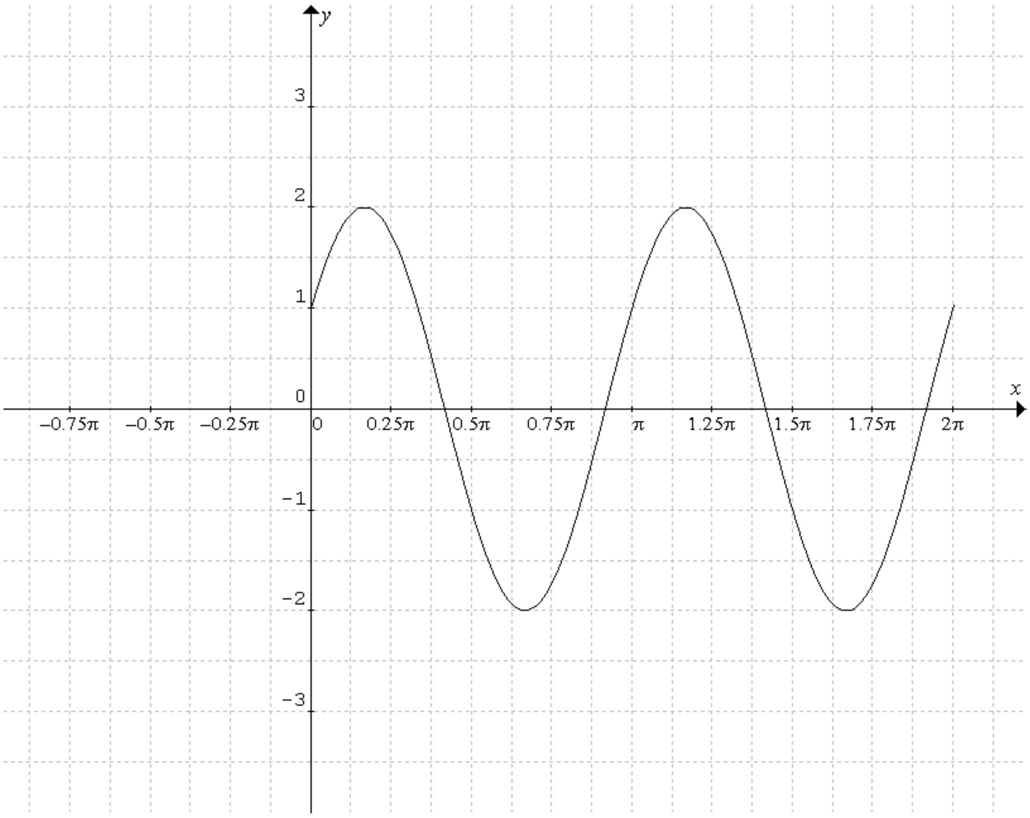
$2x=\frac{\pi}{3},\frac{\pi}{3}+\pi,\frac{\pi}{3}+2\pi,\frac{\pi}{3}+3\pi$ M1

$2x=\frac{\pi}{3},\frac{4\pi}{3},\frac{7\pi}{3},\frac{10\pi}{3}$

$x=\frac{\pi}{6},\frac{2\pi}{3},\frac{7\pi}{6},\frac{5\pi}{3}$ A1

**ii.** max $\left(\frac{\pi}{6},2\right)$ and $\left(\frac{7\pi}{6},2\right)$ , min $\left(\frac{2\pi}{3},-2\right)$ and $\left(\frac{5\pi}{3},-2\right)$ A1

**c.** graph on correct domain, correct *x*-intercepts G1
and correct max and min. G1




**d.** $f(x)=\sqrt{3}\sin(2x)+\cos(2x)=2\sin\left(2x+\frac{\pi}{6}\right)=2\sin\left(2\left(x+\frac{\pi}{12}\right)\right)$

translate $2\sin(2x)$ , $\frac{\pi}{12}$ to the left parallel to the *x*-axis

$A=2$ A1

$\alpha=\frac{\pi}{12}$ A1

**END OF SECTION 2 SUGGESTED ANSWERS**