2025 A Math Prelim Paper 1 Solutions

1. (a)

$$V = \frac{1}{3}\pi r^2\left(\frac{3}{4}r\right)$$

$$= \frac{\pi}{4}r^3$$

(b)

$$\frac{dv}{dr} = \frac{3\pi}{4}r^2$$

$$\frac{dv}{dt} = \frac{dv}{dr} \times \frac{dr}{dt}$$

$$16 = \frac{3\pi}{4}(8)^2 \times \frac{dr}{dt}$$

$$\frac{dr}{dt} = \frac{1}{3\pi} = 0.106 \text{ cm/s}$$

2.

$$y = 1 - 2x \quad -----(1)$$

$$x^2 - xy - y^2 + 5 = 0 \quad -----(2)$$

Sub (1) into (2)

$$x^2 - x(1-2x) - (1-2x)^2 + 5 = 0$$

$$x^2 - x + 2x^2 - 1 + 4x - 4x^2 + 5 = 0$$

$$-x^2 + 3x + 4 = 0$$

$$x^2 - 3x - 4 = 0$$

$$(x-4)(x+1) = 0$$

$$x = 4 \text{ or } -1$$

$$y = -7 \text{ or } 3$$

$$\text{Length} = \sqrt{(4+1)^2 + (-7-3)^2}$$

$$= \sqrt{125}$$

$$= 5\sqrt{5} \text{ units}$$

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3(a)

$$\frac{d}{dx}(2x-3)e^{2x} = 2e^{2x} + (2x-3)2e^{2x}$$
$$= 2e^{2x}(1+2x-3)$$
$$= 4e^{2x}(x-1)$$

(b)

$$\int 4e^{2x}(x-1)\,dx = (2x-3)e^{2x} + c$$
$$\int 4xe^{2x}\,dx - \int 4e^{2x}\,dx = (2x-3)e^{2x} + c$$
$$\int 4xe^{2x}\,dx = (2x-3)e^{2x} + \int 4e^{2x}\,dx + c$$
$$\int 4xe^{2x}\,dx = (2x-3)e^{2x} + 2e^{2x} + c$$
$$\int 4xe^{2x}\,dx = (2x-1)e^{2x} + c$$
$$\int_0^1 4xe^{2x}\,dx = \left[(2x-1)e^{2x}\right]_0^1$$
$$= e^2 - (-1)$$
$$= e^2 + 1$$

4(a)

$\angle RSU = \angle RUS$ $(RS = RU)$
$= \angle URQ$ (alt seg thm)
$\angle URQ = \angle RUQ$
$\therefore \Delta RQU$ is isosceles

(b)

$\angle RQS = 2\angle QRU$ (ext $\angle$ of a triangle, ΔRQU is isosceles)
$\angle RQS = \angle SPT$ (angles in the same seg)
$\angle QRU = \angle QPT$ (alt seg theorem)
$\therefore \angle SPT = 2\angle QPT$

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5(a)

$2x^2-8x+3=1-4x$

$2x^2-4x+2=0$

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

$x=1$

Since there is only one intersection point between the curve and the line, the line is a tangent to the curve.

Or

Discriminant = $(-4)^2-4(2)(2)=0$

$\therefore$ line is a tangent to the curve

Coordinates = $(1, -3)$

(b)

$(m+1)x^2-8x+3m>5$

$(m+1)x^2-8x+3m-5>0$

$(-8)^2-4(m+1)(3m-5)<0$ and $m+1>0$

$64-12m^2+8m+20<0$ $\qquad m>-1$

$12m^2-8m-84>0$

$3m^2-2m-21>0$

$(3m+7)(m-3)>0$

$m<-\frac{7}{3}$ or $m>3$

$\therefore\ m>3$

6(a)

$$\begin{array}{r} x\ -2 \\ 2x^2+1\overline{)\ 2x^3-4x^2+x-2} \\ \underline{-(2x^3\quad +x)} \\ -4x^2\quad -2 \\ \underline{-(-4x^2\quad -2)} \\ 0 \end{array}$$

$\therefore 2x^2+1$ is a factor since remainder = 0

(b)

$$\frac{11x-5x^2-11}{(x-2)(2x^2+1)}=\frac{A}{x-2}+\frac{Bx+C}{2x^2+1}$$

$11x-5x^2-11=A(2x^2+1)+(Bx+C)(x-2)$

Sub $x=2$,

$-9=9A \Rightarrow A=-1$

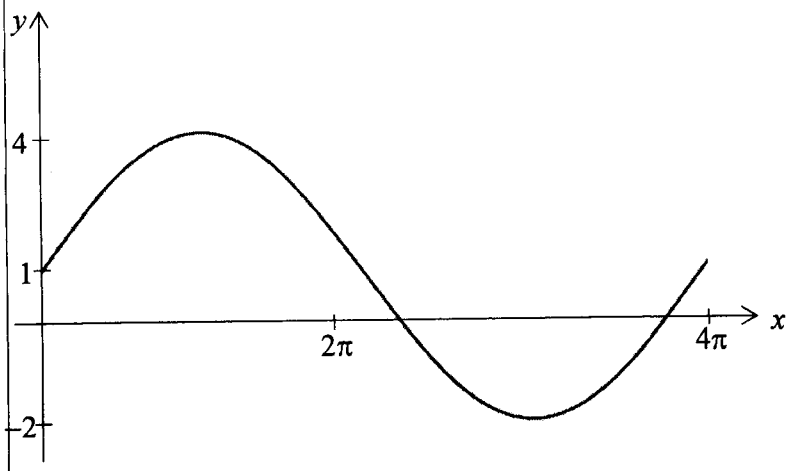
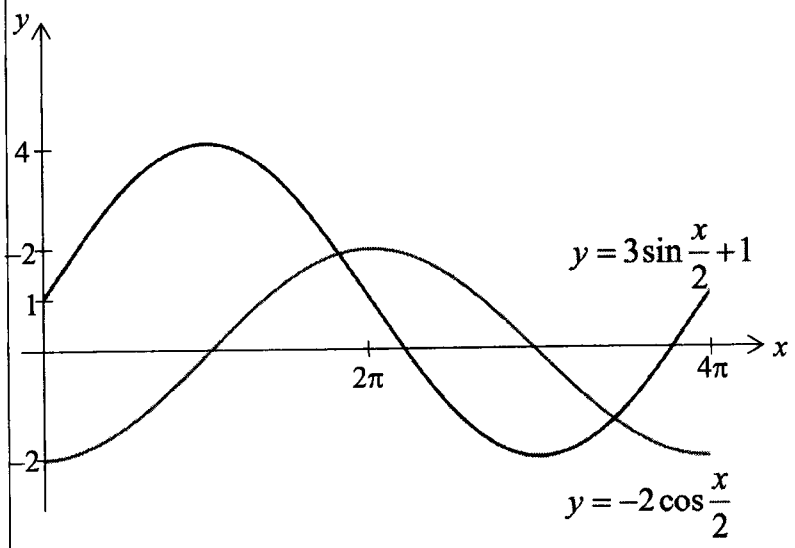
Compare x^2,

$-5=2A+B \Rightarrow B=-3$

Compare constants,

$-11=A-2C \Rightarrow C=5$

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	$\therefore \dfrac{11x-5x^2-11}{(x-2)(2x^2+1)} = -\dfrac{1}{x-2}+\dfrac{5-3x}{2x^2+1}$
7(a)	Amplitude =3 Period = 4π or 720°
(b)	
(c)	 $3\sin\frac{x}{2}+1=-2\cos\frac{x}{2}$ Sketch $y=-2\cos\frac{x}{2}$ Number of solutions = 2

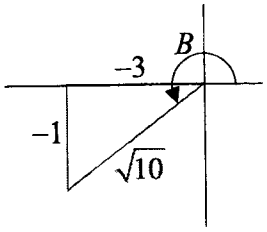
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8(a)	Centre of $C_1 = (2, y)$ Grad of normal $= \frac{3}{4}$ $\frac{y-6}{2-6} = \frac{3}{4}$ $y = \frac{3}{4}(-4) + 6$ $= 3$ $\therefore$ Centre of $C_1 = (2, 3)$ Radius = 5 units Equation of C_1: $(x-2)^2 + (y-3)^2 = 25$
(b)	Let the centre $C_2 = (x, y)$ $\left(\frac{x+2}{2}, \frac{y+3}{2}\right) = (6, 6)$ $x = 10,\ y = 9$ Equation of C_2: $(x-10)^2 + (y-9)^2 = 25$
9(a)	$\sin 105° = \sin(45° + 60°)$ $= \sin 45° \cos 60° + \cos 45° \sin 60°$ $= \frac{1}{\sqrt{2}}\left(\frac{1}{2}\right) + \left(\frac{1}{\sqrt{2}}\right)\left(\frac{\sqrt{3}}{2}\right)$ $= \frac{1+\sqrt{3}}{2\sqrt{2}}$ $= \frac{1}{4}(\sqrt{2} + \sqrt{6})$
(b)	$\frac{\cos(A+B)}{\cos(A-B)} = \frac{2}{7}$ $\frac{\cos A \cos B - \sin A \sin B}{\cos A \cos B + \sin A \sin B} = \frac{2}{7}$ $7\cos A \cos B - 7\sin A \sin B = 2\cos A \cos B + 2\sin A \sin B$ $\frac{5\cos A \cos B}{9\sin A \sin B} = 1$ $\cot A \cot B = \frac{9}{5}$

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(c)

$\tan B = \frac{1}{3}$



$\cos 2B = 2\cos^2 B - 1$

$= 2\left(-\frac{3}{\sqrt{10}}\right)^2 - 1$

$= \frac{4}{5}$

or

$\cos 2B = 1 - 2\sin^2 B$

$= 1 - 2\left(-\frac{1}{\sqrt{10}}\right)^2$

$= \frac{4}{5}$

or

$\cos 2B = \cos^2 B - \sin^2 B$

$= \left(-\frac{3}{\sqrt{10}}\right)^2 - \left(-\frac{1}{\sqrt{10}}\right)^2$

$= \frac{4}{5}$

10(a)

$V = \pi r^2 h$

$300 = \pi r^2 h$

$h = \frac{300}{\pi r^2}$

(b)

$A = 2\pi r^2 + 2\pi r\left(\frac{300}{\pi r^2}\right)$

$= 2\pi r^2 + \frac{600}{r}$

$C = 60\left(2\pi r^2\right) + 60\left(\frac{600}{r}\right)$

$= 120\pi r^2 + \frac{36000}{r}$ (Shown)

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(c)

$$C = 120\pi r^2 + \frac{36000}{r}$$

$$\frac{dC}{dr} = 240\pi r - \frac{36000}{r^2}$$

$$\frac{dC}{dr} = 0$$

$$\Rightarrow \quad 240\pi r - \frac{36000}{r^2} = 0$$

$$\Rightarrow \frac{36000}{r^2} = 240\pi r$$

$$\Rightarrow r^3 = \frac{36000}{240\pi}$$

$$\therefore r = 3.6278 = 3.63$$

$$\frac{dC}{dr} = 240\pi r - \frac{36000}{r^2}$$

$$\frac{d^2C}{dr^2} = 240\pi + \frac{72000}{r^3}$$

When $r = 3.6278$,

$$C = 14884.9 = 14900$$

$$\frac{d^2C}{dr^2} > 0 \Rightarrow \text{Minimum cost}$$

or

When $r = 3.6278$,

$$C = 14884.9 = 14900$$

x	3.63^-	3.63	3.63^+
$\frac{dC}{dr}$	$-$	0	$+$
slope	$\diagdown$	___	$\diagup$

$\therefore$ minimum cost

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11(a)

$$L = 13 + 6 + AD + AB$$
$$= 19 + 6\cos\theta + 13\cos\theta + 6\sin\theta + 13\sin\theta$$
$$= 19 + 19\cos\theta + 19\sin\theta$$

(b)

$$R = \sqrt{19^2 + 19^2} = \sqrt{722}$$
$$\tan^{-1}(\alpha) = 1$$
$$\alpha = 45°$$
$$L = 19 + \sqrt{722}\cos(\theta - 45°)$$
$$\text{Max } L = \sqrt{722} + 19 = 45.9\text{ m}$$

(c)

$$\sqrt{722}\cos(\theta - 45°) + 19 = 45$$
$$\cos(\theta - 45°) = \frac{26}{\sqrt{722}}$$
$$\text{Basic angle} = \cos^{-1}\left(\frac{26}{\sqrt{722}}\right)$$
$$= 14.620°$$
$$\theta - 45° = -14.620°,\ 14.620°$$
$$\therefore \theta = 30.4°,\ 59.6°$$

12(a)

$$y = \frac{1}{4}x^2 - \frac{1}{2}\ln\left(\frac{x}{3}\right)$$
$$\frac{dy}{dx} = \frac{x}{2} - \frac{1}{2}\left(\frac{1}{3}\right)\left(\frac{3}{x}\right)$$
$$= \frac{x}{2} - \frac{1}{2x}$$

When $x = 3$,

$$\frac{dy}{dx} = \frac{4}{3}$$
$$y - 2.25 = \frac{4}{3}(x - 3)$$
$$y = \frac{4}{3}x - \frac{7}{4}$$

Hence $y = \frac{4}{3}x - 1$ is not a tangent to the curve at P.

(b)

$$\frac{d}{dx}\left[x\ln\frac{x}{3} - x\right] = x\left(\frac{3}{x}\right)\left(\frac{1}{3}\right) + \ln\left(\frac{x}{3}\right) - 1$$
$$= \ln\left(\frac{x}{3}\right)$$

(c)

$$\text{Area} = \int_1^3 \left[\frac{1}{4}x^2 - \frac{1}{2}\ln\left(\frac{x}{3}\right)\right]dx$$

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$$= \left[\frac{x^3}{12}\right]_1^3 - \frac{1}{2}\left[x\ln\left(\frac{x}{3}\right) - x\right]_1^3$$

$$= \left[\frac{27}{12} - \frac{1}{12}\right] - \frac{1}{2}\left[(3\ln 1 - 3) - \left(\ln\frac{1}{3} - 1\right)\right]$$

$$= \frac{13}{6} - \frac{1}{2}\left(-2 - \ln\frac{1}{3}\right)$$

$$= \left(\frac{19}{6} + \frac{1}{2}\ln\frac{1}{3} \text{ or } \frac{19}{6} - \frac{1}{2}\ln 3 \text{ or } \frac{19}{6} - \ln\sqrt{3} \text{ or } \frac{19}{6} + \ln\sqrt{\frac{1}{3}}\right)$$

units^2

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2025 A Math Prelim Paper 2 Solutions

1(a)	$\frac{60}{100}A = Ae^k$ $e^k = \frac{3}{5}$ $k = \ln\frac{3}{5}$ *or* $3000000 = 5000000e^k$ $\ln 3000000 = \ln(5000000e^k)$ $\ln 3000000 = \ln 5000000 + \ln e^k$ $\ln 3000000 = \ln 5000000 + k$ $k = \ln 3000000 - \ln 5000000 = \ln\frac{3}{5}$
(b)	$2000 = 5000000e^{\left(\ln\frac{3}{5}\right)t}$ $\left(\ln\frac{3}{5}\right)t = \ln\frac{2000}{5000000}$ $t = \frac{\ln\left(\frac{1}{2500}\right)}{\ln\left(\frac{3}{5}\right)}$ $t = 15.3$ min
2(a)	$49u^2 - 28u - 5 = 0$ $(7u-5)(7u+1) = 0$ $u = \frac{5}{7}$ or $u = -\frac{1}{7}$ $7^x = \frac{5}{7}$ or $7^x = -\frac{1}{7}$ (rej) $x = \log_7\frac{5}{7}$ $= \log_7 5 - \log_7 7$ $= \log_7 5 - 1$ Or

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	$7^x = \frac{5}{7}$ $x \lg 7 = \lg \frac{5}{7}$ $x = \frac{\lg\left(\frac{5}{7}\right)}{\lg 7} = \log_7 \frac{5}{7} \quad [\log_a b = \frac{\log_c b}{\log_c a}]$ $Note: \frac{\lg A}{\lg B} \neq \lg(A-B)$
2 **(b)**	$\log_3(2x-1) - \log_9(x^2+2) = \log_{25} 5$ $\log_3(2x-1) - \frac{\log_3(x^2+2)}{\log_3 9} = \frac{1}{2}$ $2\log_3(2x-1) - \log_3(x^2+2) = 1$ $\log_3 \frac{(2x-1)^2}{x^2+2} = \log_3 3$ $\frac{(2x-1)^2}{x^2+2} = 3$ $4x^2 - 4x + 1 = 3x^2 + 6$ $x^2 - 4x - 5 = 0$ $(x-5)(x+1) = 0$ $x = 5$ or $x = -1$ (reject)

3(a)	$\frac{dy}{dx} = 3x^2 - 6x + 3$ $\frac{dy}{dx} = 0$ $\Rightarrow 3x^2 - 6x + 3 = 0$ $\Rightarrow 3(x-1)^2 = 0$ $x = 1$, $y = -6$ Coordinates of the stationary point are $(1, -6)$.
(b)	

x	1^-	1	1^+
$\frac{dy}{dx}$	+	0	+
	/	—	/

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	$(1,-6)$ is a point of inflexion.
4(a)	$h = 2+\frac{4}{5}t-\frac{1}{250}t^2$ $=-\frac{1}{250}\left(t^2-200t\right)+2$ $=-\frac{1}{250}\left[(t-100)^2-100^2\right]+2$ $=-\frac{1}{250}(t-100)^2+40+2$ $=42-\frac{1}{250}(t-100)^2$
(b)	Max height = 42 m Time = 100 s
(c)	$42-\frac{1}{250}(t-100)^2=32$ $\frac{1}{250}(t-100)^2=10$ $(t-100)^2=2500$ $t=100\pm 50$ $t=50$ or 150 $\therefore$ length of time = 100s Or $42-\frac{1}{250}(t-100)^2\geq 32$ $(t-100)^2\leq 2500$ $\left[(t-100)^2-50^2\right]\leq 0$ $\left[(t-100)+50\right]\left[(t-100)-50\right]\leq 0$ $(t-50)(t-150)\leq 0$ $50\leq t\leq 150$ Duration=100s

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5(a)

$f(x) = x^3 + 2kx + 2$

$f(-2) = (-2)^3 + 2k(-2) + 2$

$= -6 - 4k$

$f(1) = (1)^3 + 2k(1) + 2$

$= 2k + 3$

$-6 - 4k = 2k + 3 - 3$

$6k = -6$

$k = -1$

(b)

$f(x) = 2x^3 - 5x^2 - 3x + 10$

$f(2) = 2(2)^3 - 5(2)^2 - 3(2) + 10$

$= 0$

$\therefore (x - 2)$ is a factor

$2x^3 - 5x^2 - 3x + 10 = (x - 2)(2x^2 + bx - 5)$

Compare x^2, $-5 = -4 + b$

$b = -1$

$f(x) = (x - 2)(2x^2 - x - 5)$

When $f(x) = 0$.

$x - 2 = 0$ or $2x^2 - x - 5 = 0$

$x = 2$ or $x = \dfrac{1 \pm \sqrt{1 - 4(2)(-5)}}{4}$

$= \dfrac{1 \pm \sqrt{41}}{4}$

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6(a)

$$T_{r+1} = \binom{6}{r}\left(x^4\right)^{6-r}\left(-\frac{1}{kx^2}\right)^r$$

$$= \binom{6}{r}\left(-\frac{1}{k}\right)^r \left(x^{24-4r}\right)x^{-2r}$$

$$= \binom{6}{r}\left(-\frac{1}{k}\right)^r x^{24-6r}$$

Powers of $x = 24 - 6r$
Since 24 and $6r$ are even numbers,
subtraction between even numbers will give an even number.
$\therefore$ there are only even powers of x in this expansion.

(b)

$24 - 6r = 0$

$r = 4$

$$\binom{6}{4}\left(-\frac{1}{k}\right)^4 = \frac{5}{27}$$

$$\left(-\frac{1}{k}\right)^4 = \frac{1}{81}$$

$$k = 3$$

(c)

$24 - 6r = -6$

$r = 5$

Coefficient of $x^{-6} = \binom{6}{5}\left(-\frac{1}{3}\right)^5 = -\frac{6}{243} = -\frac{2}{81}$

For the expansion $\left(2 - 3x^6\right)\left(x^4 - \frac{1}{kx^2}\right)^6$

Term independent of $x = 2\left(\frac{5}{27}\right) - 3\left(-\frac{6}{243}\right)$

$$= \frac{10}{27} + \frac{2}{27}$$

$$= \frac{12}{27}$$

$$= \frac{4}{9}$$

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7(a)

When $t = 0$,

$v = \cos\frac{\pi}{6} = \frac{\sqrt{3}}{2}$ m/s

(b)

When $v = 0$,

$\cos(\frac{\pi}{4}t + \frac{\pi}{6}) = 0$

$\frac{\pi}{4}t + \frac{\pi}{6} = \frac{\pi}{2}$ or $\frac{\pi}{4}t + \frac{\pi}{6} = \frac{3\pi}{2}$

$t = \frac{4}{3}$ or $\frac{16}{3} = 1.33$ or 5.33

$\cos(\frac{\pi}{4}t + \frac{\pi}{6}) = 0$

$\frac{\pi}{4}t + \frac{\pi}{6} = \frac{\pi}{2}$ or $\frac{\pi}{4}t + \frac{\pi}{6} = \frac{3\pi}{2}$

$t = \frac{4}{3}$ or $\frac{16}{3} = 1.33$ or 5.33

(c)

$s = \int \cos(\frac{\pi}{4}t + \frac{\pi}{6})\, dt$

$s = \frac{4}{\pi}\sin(\frac{\pi}{4}t + \frac{\pi}{6}) + c$

When $t = 0$, $s = \frac{1}{\pi}$,

$\frac{1}{\pi} = \frac{4}{\pi}\left(\sin\frac{\pi}{6}\right) + c$

$\frac{1}{\pi} = \frac{4}{\pi}\left(\frac{1}{2}\right) + c$

$c = \frac{1}{\pi} - \frac{2}{\pi} = -\frac{1}{\pi}$

$\therefore s = \frac{4}{\pi}\left[\sin(\frac{\pi}{4}t + \frac{\pi}{6})\right] - \frac{1}{\pi}$

When $t = 0$ $\quad s = \frac{1}{\pi}$m $= 0.31830$ m

When $t = \frac{4}{3}$ $\quad s = \frac{4}{\pi}\left(\sin\frac{\pi}{2}\right) - \frac{1}{\pi} = \frac{3}{\pi}$m or 0.95492 m

When $t = 4$ $\quad s = \frac{4}{\pi}\left(\sin\frac{7\pi}{6}\right) - \frac{1}{\pi} = -\frac{3}{\pi}$ or -0.95492 m

Total distance travelled $= \frac{2}{\pi} + \frac{3}{\pi} + \frac{3}{\pi} = \frac{8}{\pi}$ or 2.55 m

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8(a)

$$\text{LHS} = \sin^3 x \sec^2 x + \sin x$$

$$= \sin^3 x \left(\frac{1}{\cos^2 x}\right) + \sin x$$

$$= \tan^2 x \sin x + \sin x$$

$$= \sin x \left(\tan^2 x + 1\right)$$

$$= \sin x \sec^2 x$$

$$= \sin x \left(\frac{1}{\cos^2 x}\right)$$

$$= \tan x \sec x$$

$$= \text{RHS (shown)}$$

(b)

$$\tan x \sec x = 5$$

$$\frac{\sin x}{\cos x}\left(\frac{1}{\cos x}\right) = 5$$

$$\frac{\sin x}{\cos^2 x} = 5$$

$$\sin x = 5\left(1 - \sin^2 x\right)$$

$$5\sin^2 x + \sin x - 5 = 0$$

$$\sin x = \frac{-1 \pm \sqrt{(1)^2 - 4(5)(-5)}}{2(5)}$$

$\sin x = 0.90498$ or -1.10498 (NA)

Basic angle = 64.8215°

$x = 64.8°,\ 115.2°$

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9(a)(i)	$y = \dfrac{2x-6}{x-2}$ $\dfrac{dy}{dx} = \dfrac{(x-2)(2)-(2x-6)(1)}{(x-2)^2}$ $= \dfrac{2}{(x-2)^2}$ When the curve meets the y-axis, $x = 0$ $\dfrac{dy}{dx} = \dfrac{2}{(0-2)^2} = \dfrac{1}{2}$ Gradient of normal $= -2$ $x = 0, y = 3$ Equation of normal is $y - 3 = -2(x-0)$ $y = -2x + 3$
9(a)(ii)	For $x > 2$, $x - 2 > 0$, $\Rightarrow (x-2)^2 > 0$ Since $\dfrac{dy}{dx} = \dfrac{2}{(x-2)^2} > 0$ for $x > 2$, y is an increasing function.

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9b

$$\frac{d^2y}{dx^2} = (3x+1)^2$$

$$\frac{dy}{dx} = \int (3x+1)^2 \, dx$$

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

$$= \frac{(3x+1)^3}{9} + C$$

$$\frac{dy}{dx} = 45, \; x = 2,$$

$$45 = \frac{343}{9} + C$$

$$C = \frac{62}{9}$$

$$\frac{dy}{dx} = \frac{(3x+1)^3}{9} + \frac{62}{9}$$

$$y = \int \left[\frac{(3x+1)^3}{9} + \frac{62}{9} \right] dx$$

$$y = \frac{(3x+1)^4}{108} + \frac{62}{9}x + D$$

$$36 = \frac{2401}{108} + \frac{124}{9} + D$$

$$D = -\frac{1}{108}$$

$$\therefore y = \frac{(3x+1)^4}{108} + \frac{62}{9}x - \frac{1}{108}$$

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Solution 1

10(a)

$n = n_0(2)^{kt}$

$\lg n = \lg n_0 + (k \lg 2)t$

Draw a straight line of $\lg n$ against t.

t	2	4	6	8	10
$\lg n$	3.51	3.54	3.57	3.60	3.63

Best fit line

(b)

$\lg n_o = 3.48$

$n_o = 10^{3.48}$

$= 3020$

(c)

$k \lg 2 = \dfrac{3.584 - 3.48}{7}$

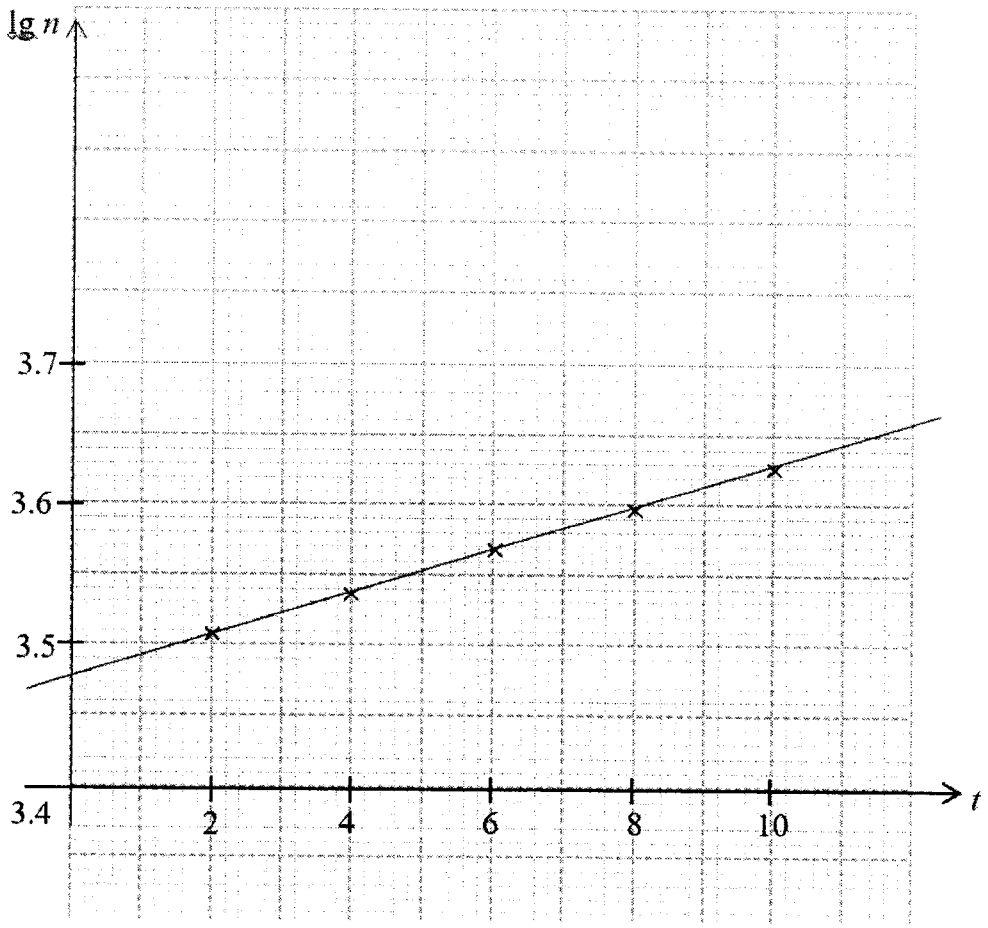
$k = 0.0494$

(d)

$\lg\left[1.25\left(10^{3.48}\right)\right] = 3.58$

$t = 6.7$ (6.6 - 7.2)

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Solution 2

10(a)

$n = n_0(2)^{kt}$

$\ln n = \ln(n_o) + (k \ln 2)t$

Draw a straight line of $\ln n$ against t.

t	2	4	6	8	10
$\ln n$	8.08	8.14	8.21	8.28	8.35

Best fit line

(b)

$\ln n_o = 8.00$

$n_o = e^8$

$= 2980.957$

$= 2980$

(c)

$k \ln 2 = \dfrac{8.35 - 8.0}{10}$

$k = 0.050494$

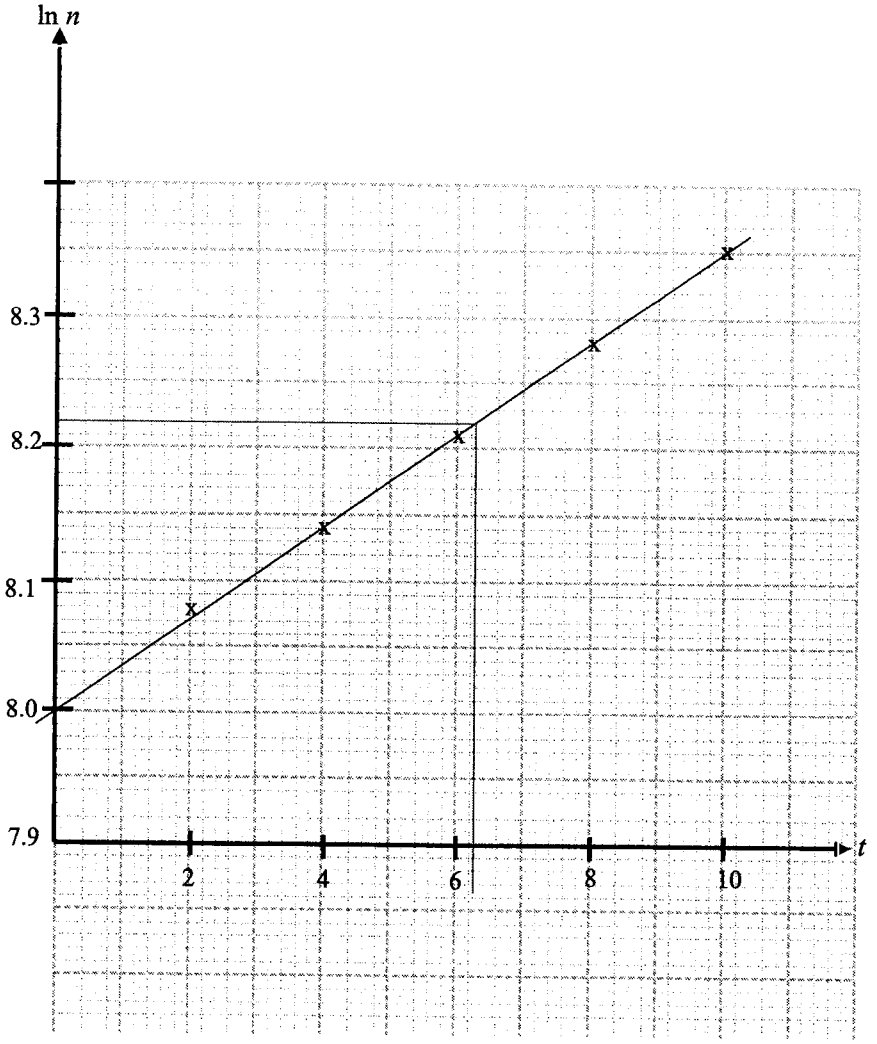
$= 0.0505$

(d)

$\ln\left[1.25\left(e^8\right)\right] = 8.223$

$t = 6.3$ (6.0 - 6.6)

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11(a)

Let $B = (x, y)$

Distance $AB = \sqrt{(x-6)^2 + (y-8)^2} = 15$

$$(x-6)^2 + (y-8)^2 = 225 \quad \text{------ (1)}$$

Grad $AB = \frac{4}{3}$

Equation of AB: $y = \frac{4}{3}x$ ------ (2)

Solving, $(x-6)^2 + \left(\frac{4}{3}x - 8\right)^2 = 225$

$$\frac{25}{9}x^2 - \frac{100}{3}x - 125 = 0$$

$$x^2 - 12x - 45 = 0$$

$$(x+3)(x-15) = 0$$

$$x = -3 \quad \text{or} \quad x = 15 \text{ (rej)}$$

$$y = -4$$

$\therefore B = (-3, -4)$

Or

Distance $OA = \sqrt{6^2 + 8^2} = 10$ units

Distance $OB = 5$ units

Let $B = (x, y)$

By ratio theorem,

$$\frac{5(6) + 10x}{15} = 0, \quad \frac{5(8) + 10y}{15} = 0$$

$\therefore B = (-3, -4)$

(b)

Grad $BC = -\frac{3}{4}$

$$y = -\frac{3}{4}x + c$$

$$-4 = -\frac{3}{4}(-3) + c \Rightarrow c = -\frac{25}{4}$$

Coordinates of $C = \left(0, -\frac{25}{4}\right)$

Let $D = (x, 0)$

$$\frac{\frac{25}{4}}{x} = \frac{4}{3}$$

$$x = \frac{75}{16}$$

Coordinates of $D = \left(\frac{75}{16}, 0\right)$

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(c)

$$\text{Area} = \frac{1}{2}\begin{vmatrix} 6 & -3 & 0 & \frac{75}{16} & 6 \\ 8 & -4 & -\frac{25}{4} & 0 & 8 \end{vmatrix}$$

$$= \frac{1}{2}\left|-24+\frac{75}{4}+\frac{75}{2}-\left(-24-\frac{1875}{64}\right)\right|$$

$$= \frac{5475}{128} \text{ or } 42\frac{99}{128} \text{ or } 42.8 \text{ units}^2$$

or

$$\text{Area} = \frac{1}{2}(AB+CD)(BC)$$

$$= \frac{1}{2}\left(15+\frac{125}{16}\right)\left(\frac{15}{4}\right) = \frac{5475}{128}$$

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