# 2008 AB Calculus FR
## Calculator

(1) $y = \sin(\pi x)$ $\quad y = x^3 - 4x$

a) $\int_0^2 [(\sin(\pi x)) - (x^3 - 4x)]\,dx = \boxed{4}$

b) $\int_{.539}^{1.675} [-2 - (x^3 - 4x)]\,dx$

c) side $= \sin(\pi x) - (x^3 - 4x)$

$$\int_0^2 (\sin(\pi x) - (x^3 - 4x))^2\,dx = \boxed{9.978}$$

d) $\int_0^2 [(\sin(\pi x) - (x^3 - 4x))(3 - x)]\,dx$ Volume

$= 8.36995 \approx \boxed{8.37}$

4.89 2008 AB
6.38 2008 BC

a) $\frac{150-126}{7-4} = \boxed{18 \text{ people/hr}}$ 1 1

#12

$\frac{1}{2}h(b_1+b_2)$

b) 1 $\frac{1}{2}(1)(120+156) + \frac{1}{2}(2)(156+176) + \frac{1}{2}(1)(176+126)$

$\frac{1}{2}(276) + 1(332) + \frac{1}{2}(302)$

$138 + 332 + 151 = 621$

$621/4 = \boxed{155.25}$ (155) 1 people

c) 1 $L'(t)$ must $= 0$ 1 atleast $\boxed{3 \text{ times.}}$ 1/2

The slope changes signs 3 times in this interval. (must state where and how it changes) 1

d) $r(t) = 550te^{-t/2}$ tickets/hour

1 $\int_0^3 550te^{-t/2}\,dt =$ 1 $\boxed{973 \text{ tickets}}$

972.784

3,36 2008 AB

5.1 2008 BC

3 $\frac{dV}{dt} = 2000$ *     $V = \pi r^2 h$

a) $r = 100$   $h = .5$   $\frac{dr}{dt} = 2.5$ *   $\frac{dh}{dt} =$   1

$\frac{dV}{dt} = \pi r^2 \frac{dh}{dt} + h\, 2\pi r \frac{dr}{dt}$   2

$2000 = \pi(100)^2\left(\frac{dh}{dt}\right) + .5(2)\pi(100)(2.5)$

$\frac{dh}{dt} = \frac{2000 - 250\pi}{(100)^2\pi} = \boxed{.039 \text{ cm/min}}$   1

b) $R(t) = 400\sqrt{t}$

$2000 - 400\sqrt{t} = 0$   1     $\sqrt{t} = \frac{2000}{400}$

$-400\sqrt{t} = -2000$     $t = 25$

max when $V'(t) = 2000 - 400\sqrt{t}$ changes from + to −   1

graph $V'(t)$   $\boxed{t = 25 \text{ minutes}}$   1

c) $V(25) = V(0) + \int_0^{25} 2000 - 400\sqrt{t})\,dt$

$\boxed{60{,}000 + \int_0^{25} (2000 - R(t))\,dt}$   2

2.45   2008 AB

Calculus AB (no calculator)

4 a) particle is farthest left at absolute minimum which could be $X=0$, $X=6$, or at relative min $X=3$ 1

$X(0) = -2$    $X(3) = X(0) + \int_0^3 v(t) = -2 - 8 = -10$

$X(6) = X(3) + \int_3^6 v(t)\,dt = X(3) + \int_3^5 v(t) + \int_5^6 v(t)\,dt =$ 1

$-10 + 3 - 2 = -9$

so, farthest at $\boxed{X(3)}$ 1

b) $x(0) = -2$, $x(3) = -10$ there must be a place where $x(t) = -8$

1 $x(3) = -10$   $x(5) = -7$
$x(5) = -7$   $x(6) = -9$  } same reason  $\boxed{3 \text{ values}}$ 1  IVT 1

or talk about movement back and forth

c) 1 decreasing - ~~it is~~ vel getting closer to 0, ($v$ and $v'$ have different signs)

or $v<0$ and $v$ is inc

d) Acceleration is negative when $v(t)$ is
1 decreasing $(0,1)$ 1 $(4,6)$

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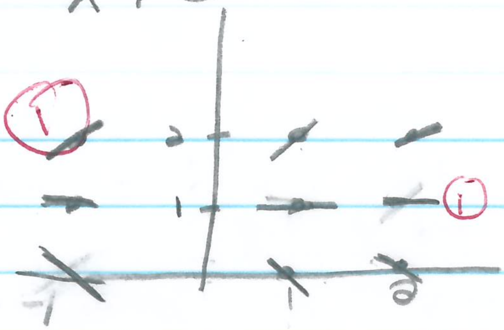
$\boxed{2.6}$ 2008 AB

$\boxed{4.26}$ 2008 BC

⑤ $\frac{dy}{dx} = \frac{y-1}{x^2}$ $x \neq 0$ no calculator

a)

| $x$ | $y$ | $\frac{dy}{dx}$ |
|---|---|---|
| 1 | 0 | −1 |
| 2 | 0 | −1/4 |
| 1 | 1 | 0 |
| 1 | 2 | 1 |
| 2 | 2 | 1/4 |
| −1 | 2 | 1 |
| −1 | 1 | 0 |
| −1 | 0 | 1 |



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b) $f(2)=0$

$$\frac{dy}{dx} = \frac{y-1}{x^2}$$

$$\int \frac{1}{y-1}\,dy = \int \frac{1}{x^2}\,dx \quad 1 \qquad \int x^{-2}$$

$$\ln|y-1| = -\frac{1}{x} + C \quad 1$$

$$\ln|0-1| = -\frac{1}{2} + C$$

$$\ln 1 = -\frac{1}{2} + C \qquad \boxed{C = 1/2} \quad 1$$

$$\ln|y-1| = -\frac{1}{x} + \frac{1}{2}$$

$$|y-1| = e^{-1/x + 1/2} \qquad e^{-1/x} \cdot e^{1/2}$$

$$|y-1| = e^{-1/x}\sqrt{e}$$

$$y = \pm e^{-1/x}\sqrt{e} + 1$$

negative since $f(2) = 0 < 1$

$$y = -\sqrt{e}/e^{1/x} + 1$$

c) $\lim_{x\to\infty} -\frac{\sqrt{e}}{e^{1/x}} + 1 = \boxed{-\sqrt{e}+1}$ 1

$\boxed{3.7}$ 2008 AB

no calculator

⑥ $f(x) = \frac{\ln x}{x}$ $\quad f'(x) = \frac{1-\ln x}{x^2}$

a) $f'(x) = \frac{1-\ln e^2}{e^4} = \frac{1-2}{e^4} = \frac{-1}{e^4}$ $\quad x = e^2$

$y = 2/e^2$

$\boxed{y - \frac{2}{e^2} = \frac{-1}{e^4}(x - e^2)}$ 1 $\quad \boxed{(e^2, \frac{2}{e^2})}$ 1

b) $\frac{1-\ln x}{x^2} = 0$ $\quad 1 - \ln x = 0$

$-\ln x = -1$

$\ln x = 1$

$\boxed{x = e}$ 1

$f'(x)$ $\xleftarrow{\quad + \quad | \quad - \quad}$ $e$ is a max 1
$e$ when the derivative changes from positive 1 to negative

c) $f''(x) = \frac{x^2(-\frac{1}{x}) - (1-\ln x)(2x)}{x^4}$ 2

$= -x - 2x + 2x\ln x / x^4$

$= -3x + 2x\ln x / x^4 = \frac{-3 + 2\ln x}{x^3}$

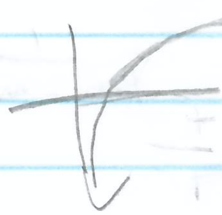
$-3 + 2\ln x = 0$

$2\ln x = 3$

$\ln x = 3/2$ 1 $\quad f''(x)$ $\xleftarrow{\quad - \quad | \quad + \quad}$ $e^{3/2}$

$\boxed{x = e^{3/2}}$

d) $\lim_{x \to 0^+} f(x) = \boxed{-\infty}$ or DNE 1



$\boxed{3,06}$ 2008 AB

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