? p 329 #23

$y = x \cdot \sin x$ Find area

a) $0 \le x \le \pi$

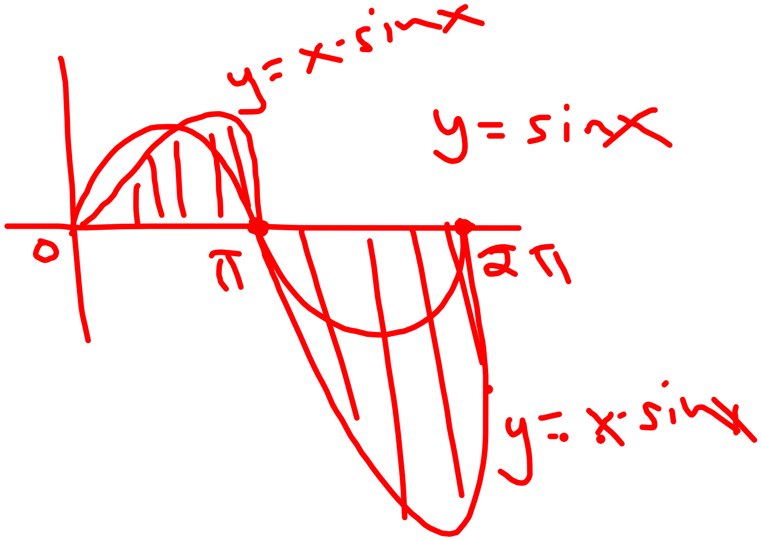
b) $\pi \le x \le 2\pi$

c) $0 \le x \le 2\pi$

$F(x) = \int x \sin x \, dx$

$F(x) = -x\cos x + \sin x$

+ x	sin x
− 1	−cos x
0	−sin x



? population.
guppies.

max pop: 150

start w/ 6 guppies.

$$\frac{dP}{dt} = .0015P(150-P)$$

when $P=150$, $\frac{dP}{dt}=0$.

$$\frac{dP}{dt} = \frac{.225}{150}P(150-P)$$

★ p. 348

$$P = \frac{150}{1+Ae^{-.225t}}$$

$$\frac{k}{150} = .0015$$

$$k = .225$$

$$6 = \frac{150}{1+Ae^{-.225(0)}}$$

$$6 = \frac{150}{1+A}$$

$$6+6A = 150$$

$$6A = 144$$

$$A = 24$$

$$P = \frac{150}{1+24e^{-.225t}}$$

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"Tabular Method"

$\int u\,dv = uv - \int v\,du$

ex $\int x^4 \sin x\,dx$

$u = x^4 \quad v = -\cos x$

$du = 4x^3\,dx \quad dv = \sin x\,dx$

$= -x^4 \cdot \cos x + \int \cos x \cdot 4x^3\,dx$

$= -x^4 \cos x + 4\int x^3 \cos x\,dx$

$= \text{stuff} - \int x^2 \sin x\,dx$ ← guess

$= \text{stuff} - \int x^1 \cos x\,dx$

$= \text{stuff} - \int \sin x$

Thinking:

Original Integral =

stuff − (stuff − (stuff − (stuff − ∫sin x)))

	"u"	"dv"
	x^4	$\sin x$
−	$4x^3$	$-\cos x$
+	$12x^2$	$-\sin x$
−	$24x$	$\cos x$
+	24	$\sin x$
	0	$-\cos x$

1st u·v

2nd u·v

$-x^4\cos x + 4x^3\sin x + 12x^2\cos x - 24x\sin x - 24\cos x + C$

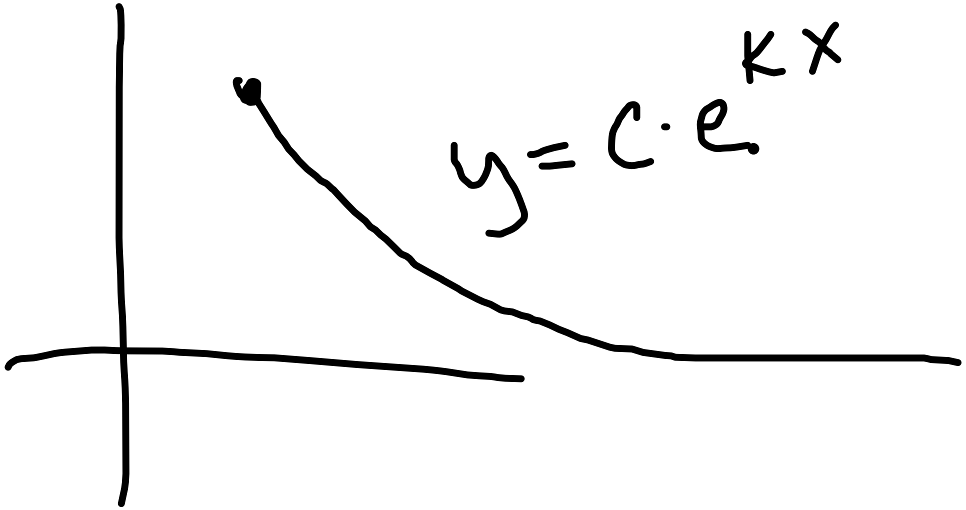
p 348

#22

$$\frac{dP}{dx} = \frac{-1}{100} P$$

$P(100) = 20.09$

$$P = C \cdot e^{-1/100 \cdot x}$$



$$y = C \cdot e^{kx}$$

$$\frac{dy}{dt} = -.001y$$

kinda like

$$\frac{dy}{dt} = .05y$$

$$\int \frac{1}{y}\,dy = \int .05\,dt$$

$$\ln|y| + C = .05t + C$$

$$\ln|y| = .05t + C$$

$$|y| = e^{.05t + C}$$

$$|y| = e^{.05t} \cdot C$$

$$\boxed{y = C \cdot e^{.05t}}$$

$$\frac{dP}{dt} = k \cdot P$$

$$\Longrightarrow \boxed{P = C \cdot e^{kt}}$$

$$\boxed{y = y_0 \cdot e^{kt}}$$

P.348

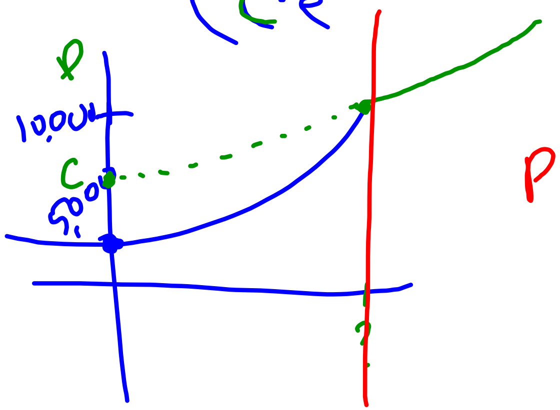
Honeybees.

$$\frac{dP}{dt} = \frac{1}{4}P \quad \text{when } P < 10{,}000$$

$$\frac{dP}{dt} = \frac{1}{12}P \quad \text{when } 10{,}000 < P < 50{,}000$$

There are 5,000 bees today.
When will $P = 25{,}000$?

$$P = \begin{cases} 5000e^{.25t} & P < 10{,}000 \\ C \cdot e^{\frac{1}{12}t} & 10{,}000 < P < 50{,}000 \end{cases}$$



$$P = 10{,}000 \cdot e^{\frac{1}{12}(t-?)}$$

"Newton's law of Cooling"

$$\text{Temp Diff} = \text{Temp Diff}_0 \cdot e^{Kt}$$

$$T - T_s = (T_0 - T_s) \cdot e^{Kt}$$

T_s = room temp

T_0 = original temp

T = temp

t = time

$$T = (T_0 - T_s) \cdot e^{Kt} + T_s$$