MATH 145 WTR, 2006, Course Outline

SYLLABUS

M145 Assignment I Due Tue Jan 10, 2005

Section 18 (Antiderivatives, p205) 3, 5, 10, 17, 20, 33, 37, 41, 43, 51

Practice problems:

Section 18 (Antiderivatives, p205) 2, 7, 11, 13, 20

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M145 Worksheet # 1a Tue, Jan 3, 2006

(1) $\int (x^7 + x)\,dx =$

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

(3) $\int \frac{(x^4 + x^2 + 1)\,dx}{x} =$

(4) $\int (x^2 + 3)\,dx =$

(5) $\int (x + 1)^4 dx =$

(6) $\int (3x + 2)^5 dx =$

(7) $\int e^{2x}\,dx =$

(8) $\int e^{-3x}\,dx =$

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

M145 Worksheet # 1b Thurs, Jan 5, 2006

(1) $\int x^{\frac{2}{5}}\,dx =$

(2) $\int \frac{x^4 + x^2 + 1 + x^{-1}}{\sqrt{x}}\,dx =$

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

(4) $\int e^{-\frac{x}{2}}\,dx =$

(5) $\int_1^2 (x^2 - 2x + 1)\,dx =$

(6) $\int_2^5 \frac{dx}{x} =$

(7) Solve $y' = 3x^2 + \frac{1}{x}$ with $y(1) = 5$

(8) Solve $y' = e^{2x}$ with $y(0) = 10$

(9) Calculate the area under the curve $y = \frac{1}{x^2}$ from $x = 1$ to $x = 2$.

(10) Calculate the area under the curve $y = \sin(x)$ from $x = 0$ to $x = \pi$.

M145 Worksheet #01c for Tue, Jan 10, 2006

(1-6) Calculate each of the following antiderivatives :

(1) $\int (x^5 + x^2)\, dx$

(2) $\int e^{4x}\, dx$

(3) $\int \sin(2x)\, dx$

(4) $\int \frac{(x^2 + x + 1)\, dx}{x}$

(5) $\int x^{\frac{2}{3}}\, dx$

(6) $\int (\cos(5x) + \cos(2x))\ dx$

(7) Solve $\frac{dy}{dx} = 2x - 1$, given that $y = 4$ when $x = 2$.

M145 Worksheet #01d for Tue, Jan 10, 2006

Calculate each of the antiderivatives in **(1-7)** .

(1) $\int (x+1)^4 dx$

(2) $\int (3x+2)^5 dx$

(3) $\int (x^2+3)\, dx$

(4) $\int \sin(4x) dx$

(5) Evaluate $\int_0^1 \frac{x}{x+1}\, dx$

(6) $\int e^{-3x}\, dx$

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

(8) Solve $\frac{dy}{dx} = e^{-2x}$, given that $y(0) = 4$.

M145 Assignment II Due Tue Jan 17, 2006

Section 18 (Antiderivatives, p205) 44, 54, 67

Section 19 (The Integral, p218) 2, 14, 17

Section 20 (Fundamental Theorem of Calculus, p225) 2, 4, 20, 31

Practice problems:

Section 18 (Antiderivatives, p205) 35, 49,

Section 19 (The Integral, p218) 11, 12, 13

Section 20 (Fundamental Theorem of Calculus, p225) 1, 3, 5, 7, 29

M145 Worksheet #02a for Tue, Jan 17, 2006

(1) Solve $\dfrac{dy}{dx} = 3x^2 - 2x + 1$, given that $y = 4$ when $x = 2$.

(2) Solve $y'' = 4$, given that $y(0) = 1$ and $y'(0) = 4$.

(3) Evaluate $\displaystyle\int_0^3 \frac{2x}{3 + x^2} dx$

(4) Calculate the area between the curves $y = 3 - x^2$ and the line $x + y = 1$. You might want to sketch this region.

(5) An object moves along a line, its velocity given by $v(t)$, where $v(t) = 1 + \sin t$. How far has the object gone when $t = \pi$?

(6) Interpret each definite integral as an area. Then evaluate the definite integral.

(7a) $\displaystyle\int_2^4 (3 - 2x)\, dx$

(7b) $\displaystyle\int_{-1}^1 (4 - x^2)\, dx$

M145 Worksheet #02b for Tue, Jan 17, 2006

Calculate each of the following antiderivatives. ß

(1) $\int (x^3 - 1)^2 \, dx$

(2) $\int \left(e^{3x} + e^{-\frac{1}{2}x}\right) \, dx$

(3) $\int \left(\frac{x + 1 + x^{-1}}{\sqrt{x}}\right) \, dx$

(4) $\int (\sin(3x) + \cos(4x)) \, dx$

(5) $\int \left(\frac{x^3 + x^2 + x + 1}{x^{\frac{3}{2}}}\right) \, dx$

(1) Find the antiderivative: $\int \cos^5 x \cdot \sin x dx$

M145 Worksheet #02c for Tue, Jan 17, 2006

(1) Find the antiderivative: $\int \cos^5 x \cdot \sin x dx$

(2) Find the antiderivative: $\int_1^2 x\sqrt{3 + x^2} \, dx$

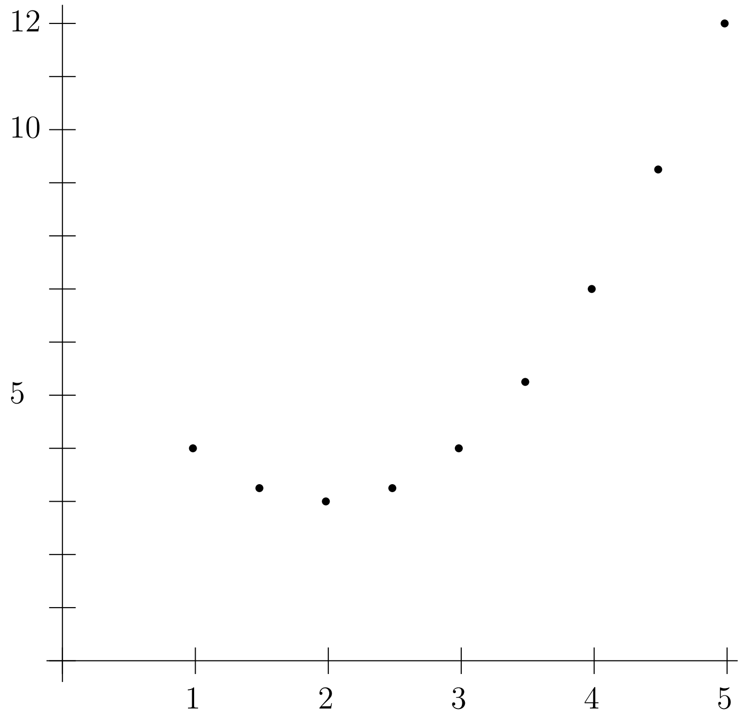
(3) Evaluate $\int_0^1 \frac{x^2}{x^3 + 1} \, dx$

(4) Evaluate $\int_0^1 \frac{dt}{1 + e^{-t}}$ Suggestion: Multiply numerator and denominator by e^t.

M145 Assignment III Due Tue Jan 24, 2006

Sections	topic	page	Problems
19	The Definite Integral	216	9
20	Fundamental Theorem of Calculus	225	20, 22
21	Areas and Volumes	236	15, 16, 17

(1a) Below is the graph of a function $y = f(x)$, with the values of $f(x)$ marked at the points $x = 1, 2, 3, 4, 5$ and the half-way points. Estimate the area under the curve from $x = 1$ to $x = 5$. Use 4 rectangles, each of base 1, and use the midpoint to calculate the height.



(1b) You are told that the function in **(1a)** is $y = x^2 - 4x + 7$. Use the Fundamental Theorem to calculate (exactly) the area under the curve from $x = 1$ to $x = 5$.

Practice problems:

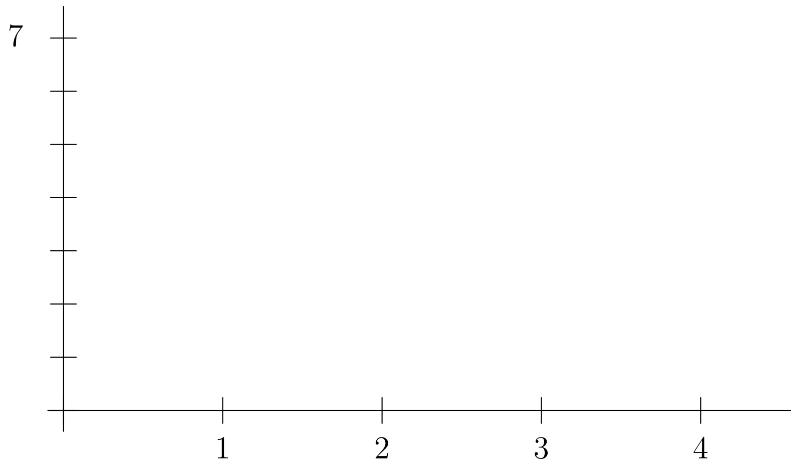
Sections	topic	page	Problems
21	Areas,	p236	1, 3, 5, 12, 13, 14.
22	Basic Integration Methods	246	5, 9, 15

M145 Worksheet #03a for Tue, Jan 24, 2006

(1a) The values of a function at the points $x = 0, 1, 2, 3, 4$ are given in the table:

x	0	1	2	3	4
$f(x)$	2	5	6	5	2

It is known that $f''(x) < 0$ for all x. Sketch a possible function for $0 \le x \le 4$ which has the function values given in the table and satisfies $f''(x) < 0$.



(1b) Subdivide the x-axis for $1 \le x \le 4$ by $\Delta x = 1$. Estimate the value of $f(x)$ at the midpoints. Use three rectangles to estimate the definite integral $\int_1^4 f(x)dx$.

(1c) The function in **(1a)** is $f(x) = -x^2 + 4x + 2$. Use the Fundamental Theorem of Calculus to calculate (exactly) the area under the curve $y = f(x)$ from $x = 1$ to $x = 4$.

(2) Evaluate: $\int_2^4 (3 - 2x)\, dx$ Interpret the integral as an area under a curve.

(3) Find the area of the region bounded by the curves $y = x^2$ and $y = (x-2)^2$, and $x = 0$ to $x = 2$. Sketch this region.

(4) Evaluate: $\int_0^{\pi/4} \sin(2x)\, dx$ Interpret the integral as an area under a curve.

(5) Calculate the area in the first quadrant between the curves $y = x^2$ and $x = y^2$. Sketch this region.

(6) Calculate the area bounded by the lines $y = 0$, $y = x$, $x = 2$, and the graph of $y = \dfrac{1}{x}$

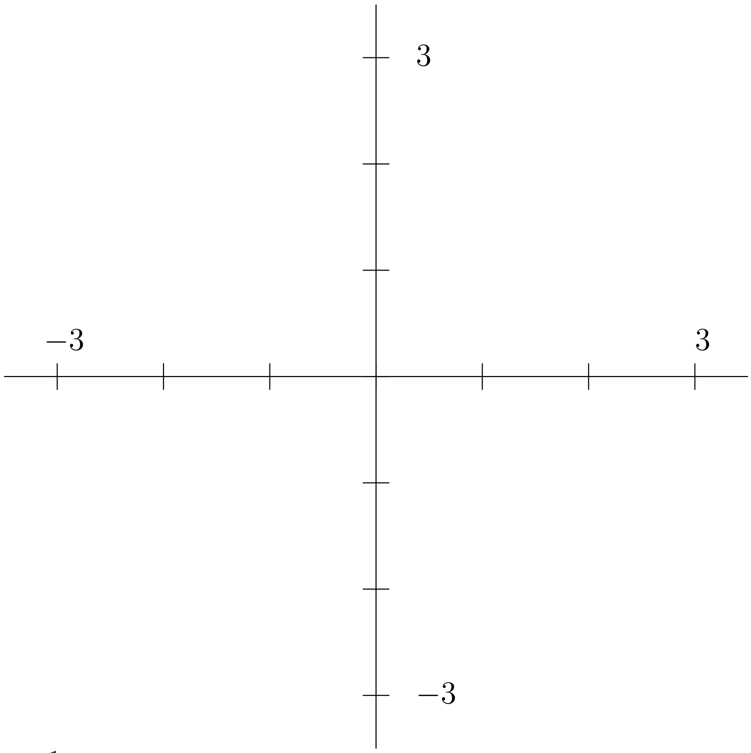
M145 Worksheet #03b for Tue, Jan 24, 2006

(1) Evaluate $\displaystyle\int_0^{\pi} \frac{\sin x}{\sqrt{2+\cos x}} dx$ Suggestion $u = 2 + \cos x$

(2) Solve $f''(x) = 6x + 2$, given that $f(1) = 9$ and $f'(1) = 10$.

(3) Evaluate $\displaystyle\int_0^{3} \frac{x}{3+x^2} dx$

(4) Calculate the area between the curves $y = 3 - x^2$ and the line $x + y = 1$. You might want to sketch this region.



(5) Evaluate $\displaystyle\int_0^{1} (x^2 - \sqrt{x})\, dx$ Interpret the integral as an area between two curves

(6) The curves $y = \dfrac{1}{x}$, $x = y^3$ and the straight line $y = \dfrac{x}{4}$ separate the first quadrant into several regions. (how many are there?)

(6a) Calculate the area of the region which contains the point $(1, 0.5)$.

(6b) Calculate the area of the region which contains the point $(1, 0.5)$.

M145 Assignment IV Due Tue Jan 31, 2006

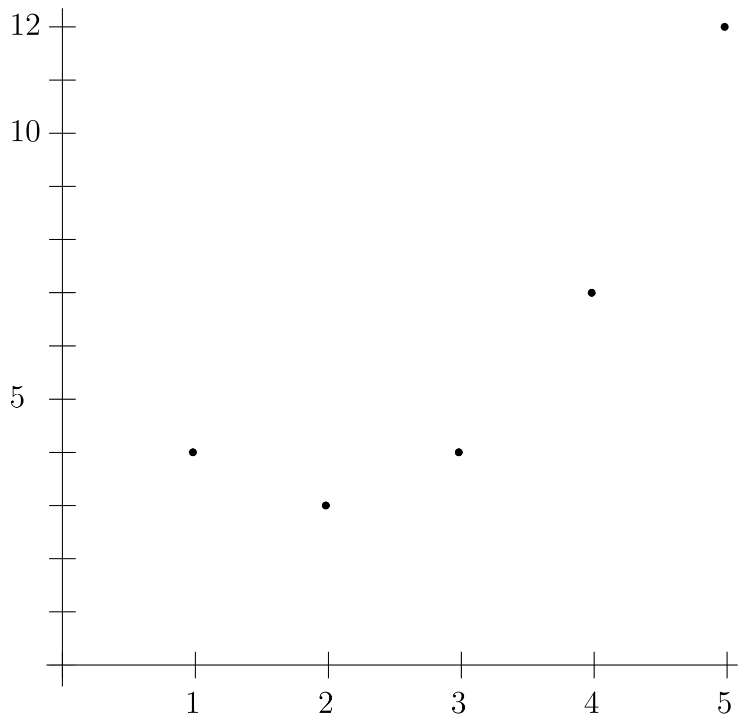
Sections	topic	page	Problems
21	Areas and Volumes,	p236	20, 21
22	Basic Integration Techniques	246	4, 6, 10, 13, 27
27	Numerical Integration	294	3a,3b,3c

(1) (Also assigned) Let R be the region in the first quadrant bounded by the curve $y = \arctan x$, the x-axis and the line $x = 1$. Sketch the region R. Express the area of R as a definite integral in **TWO** ways:

(a) with x as the variable of integration; and

(b) with y as the variable of integration. Evaluate both integrals.

Below is the graph of a function $y = f(x)$, with the values of $f(x)$ marked at the points $x = 1, 2, 3, 4, 5$.



(1) Use the trapezoid rule (4 trapezoids, with $\Delta x = 1$) to give an approximate value for the area under the curve from $x = 1$ to $x = 5$.

(1b) Use Simpson's Rule (p 289) with $\Delta x = 1$, to Estimate the area under the curve from $x = 1$ to $x = 5$.

(1c) You are told that the function in **(1a)** is $y = x^2 - 4x + 7$. Use the Fundamental Theorem of Calculus to calculate (exactly) the area under the curve from $x = 1$ to $x = 5$.

Practice problems:

Sections	topic	page	Problems
21	Areas and Volumes,	p236	27
22	Basic Integration Methods	246	19, 27
27	Numerical Integration	294	4a, 4b, 4c, 15

M145 Worksheet #04a for Tue, Jan 31, 2006

(1) Evaluate $\int_1^2 \frac{x}{1+x^2}\,dx$ Suggestion: Let $u = 1 + x^2$.

(2) Evaluate $\int_0^{\frac{\pi}{4}} \cos(x)\sin^4(x)dx$

(3) Calculate the area in the first quadrant bounded by $y = x^2$ and $y = \sqrt{x}$.

(4) A bowl in x, y, z apace is formed by rotating the curve $y = x^2$ for $0 \leq x \leq 1$ about the y-axis. Calculate the vulume inside the bowl.

(5) Evaluate: $\int_0^3 \frac{20e^t\,dt}{1+e^t}$.

(6) An object moves along the x-axis, its position at each time t given by $x(t)$, where $x(t) = 5 + 4\sin t$. Find the velocity and acceleration at time $t = \frac{\pi}{6}$.

(7) (p294 #13) Calculate by Trapezoid rule and by Simpson's rule.

(8) $\int_1^7 \frac{x}{x+2}\,dx$ Suggestion: Let $u = x + 2$.

M145 Worksheet #04b for Tue, Jan 31, 2006

(1) Evaluate $\int_0^1 xe^{-\frac{x^2}{2}}\,dx$. Suggestion: Let $u = \frac{x^2}{2}$.

(2) Evaluate $\int_1^7 \frac{1}{e}\,dx$

(3) Evaluate $\int_0^1 \frac{x}{\sqrt{1+x}}\,dx$ Suggestion: Let $u = 1 + x$.

(4) Evaluate $\int_0^{\frac{\pi}{2}} \frac{\cos\theta}{\sqrt{1+\sin\theta}}\,d\theta$ Suggestion: Let $u = 1 + \sin\theta$.

(5) (p294 #7) Calculate by Trapezoid rule and by Simpson's rule.

(6) An object moves along the x-axis for $t \geq 1$. The initial position is $x(t) = 0$, the initial velocity is 0, and its acceleration given by $a(t) = 1 + \frac{1}{t^2}$. How far has the object gone when $t = 2$?

(7) For a certain bacteria, the weight in grams at time t in days is

$$y(t) = \frac{20\ dt}{1 + 3e^{-t}}$$

The bacteria produces toxin at the following rate: Each gram of bacteria makes 0.010 mg of toxin per day. How much toxin is produced in the first 5 days?

(8) A cone is formed by rotating the line $y = \frac{x}{4}$ for $0 \leq x \leq 4$ about the $x-$axis. Calculate the volume of the come.

M145 Assignment V Due Tue Feb 7, 2006

Sections	topic	page	Problems
22	Integration Techniques	246	22, 25
24	Integration Techniques; Tables	258	11, 14, 15, 19, 36

Additional assigned problem

(1) Calculate the area common to the two circles $x^2 + y^2 = 25$ and $(x-8)^2 + y^2 = 25$.

M145 Worksheet #05a for Tue, Feb 7, 2006

(1) $\int_0^{\pi} x \sin x \, dx$

(2) $\int_0^1 e^{\sqrt{x}} \, dx$

(3) $\int_0^{\pi^2} \sin \sqrt{x} \, dx$

(4) $\int \frac{dx}{x^2 + 9}$

(5) $\int \frac{dx}{x^2 - 16}$

(6) $\int \frac{dx}{x\sqrt{x^2 - 9}}$

(7) $\int \frac{dx}{x\sqrt{x + 9}}$

(8) $\int_0^1 \frac{e^t dt}{1 + e^{2t}}$

(9) $\int_0^1 \frac{e^{2t} dt}{1 + e^t}$

(10) Find the area in the first quadrant bounded by the x-axis, the line $y = 3$, and the circle $x^2 + y^2 = 25$.

M145 Assignment VI Due Tue Feb 14, 2006

Sections	topic	page	Problems
22	Partial Fractions	246	35, 36
33	Intr. to Differential Equations	368	1, 2, 3, 17
35	Limited Population Growth	387	3, 4, 5

M145 Worksheet #06a for Tue, Feb 14, 2006

(1) Solve the equation $\frac{dy}{dt} = -2y + 8$, with $y(0) = 100$.

(2) For a certain bacteria, the weight y (in grams) at time t (in days) is

$$y(t) = \frac{20}{1 + 3e^{-0.1\,t}}$$

(2a) What is the limit of $y(t)$ as $t \to \infty$?

(2b) What is the inverse function?

(2c) At what time t does N reach 50% of its limiting value?

(2d) At what time t does N reach 95% of its limiting value?

(2e) Evaluate: $\int_0^5 \frac{20\,dt}{1 + 3e^{-0.1\,t}}$. Suggestion: multiply numerator and denominator by $e^{0.1\,t}$.

(2f) The bacteria of **(2a)** produces toxin at the following rate: Each gram of bacteria makes 0.010 mg of toxin per day. How much toxin is produced in 5 days?

(3a) Find the antiderivative: $\int \frac{dy}{y(3 - y)}$ Suggestion Table #69.

(3b) Solve the equation $\frac{dy}{dt} = y(3 - y)$, with $y(0) = 1$.

M145 Worksheet #06b for Tue, Feb 14, 2006

(1) For each time t (in days), the number of germs G is $y(t)$ (in Billions). The G are growing in such a way that $\frac{dy}{dt} = 2y - 6$ per day.

(1a) Initially (at time $t = 0$) there are 2 Billion germs. What will the numbers be for each time t? Will $y(t)$ ever become 0? If so, when?

(1b) Next suppose that initially there are 5 Billion germs. What will the numbers be for each time t? Will $y(t)$ ever become 0? If so, when?

(2) A certain nuclear power plant is creating radioactive waste W. The atoms of W are decaying, and more are being added in such a way that $\frac{dw}{dt} = -2w + 6$, where t is time in years, and the amount of W at time t is $w(t)$ in kilograms. Initially (time $t = 0$) there are 2 kilograms of W What will $w(t)$ be for each time t? Is there a limit for $w(t)$ as $t \to \infty$?

(3) Find the antiderivative: $\int \frac{1}{y(10-y)} dy$ Suggestion Table #69.

(4) Solve the equation $\frac{dy}{dt} = y(1 - \frac{y}{10})$, with $y(0) = 2$.

M145 Worksheet #06c for Tue, Feb 14, 2006

(1a) Solve the equation $\frac{dy}{dt} = -y + 4$, with $y(0) = 2$.

What is the $\lim_{t\to\infty} y(t)$? Sketch the graph of $y(t)$.

(1b) Solve the equation $\frac{dy}{dt} = -y + 4$, with $y(0) = 6$.

What is the $\lim_{t\to\infty} y(t)$? Sketch the graph of $y(t)$.

(2) In the absence of predators, a population of rabbits grows exponentially and would double in 9 months. A pack of foxes eat rabbits at a rate of 7.7 rabbits per month. Initially there are 150 rabbits. Find the number of rabbits for all times t.

(2b) Do all rabbits get eaten, and if so, at what time?

(3a) At midnight 1000 gm of yeast begins to grow exponentially. At 5 AM there are 1649 gm. At noon, an inhibitor is added to the yeast which kills the yeast at the rate of 500 gm per hour. Calculate the amount of yeast at each time t after noon.

(3b) Does all of the yeast eventually die, and if so, at what time?

M145 Assignment VII Due Tue Feb 21, 2006

Sections	topic	page	Problems
25	Density functions	266	3, 13, 21
26	Probability Density Functions	283	13, 14, 22
–	The Exponential Distribution	–	–

Additional assigned problems

(1) Find the solution: $\frac{dy}{dt} = 0.2y(1 - \frac{y}{100})$, with $y(0) = 3$. Write the function $y(t)$ in the standard form

$$y(t) = \frac{K}{1 + ae^{-r\,t}}$$

for suitable constants K, a, r.

(1b) At what time does $y(t)$ reach 99 % of its limiting value?

(2a) At midnight 1000 gm of yeast begins to grow exponentially. At 5 AM there are 1649 gm. At noon, an inhibitor is added to the yeast which kills the yeast at the rate of 500 gm per hour. Calculate the amount of yeast at each time t after noon.

(2b) Does all of the yeast eventually die, and if so, at what time?

(3a) Strontium-80 has a half life of 1.77 hours. If you have an atom of Sr-80 at 12 noon, what is the probability that it will decay some time between 1 pm and 2 pm?

(3a) What is the probability that it does not decay before 3 pm?

(3a) What is the expected lifetime of an atom of Sr-80, and what is the standard deviation of its lifetime.

M145 Worksheet #07a for Tue, Feb 21, 2006

(1) Find the antiderivative: $\int \frac{100}{y(100-y)} dy$

(2) Solve the equation $\frac{dy}{dt} = 0.5y(100-y)$, with $y(0) = 1$.

(3a) Solve the differential equation: $\frac{dy}{dt} = 0.3y(1 - \frac{y}{10})$ with $y(0) = 2$. Express your answer in the form $y = \frac{K}{1 + ae^{-rt}}$ for suitable constants K, a and r.

(3b) For which value of y is $\frac{dy}{dt}$ a maximum. What is this maximum value (of $\frac{dy}{dt}$), and at what time does it occur?

(3c) At what time does y reach 95 % of its limiting value?

(4a) A certain drug is administered intravenously at the rate of 2 mg per hour. The drug is excreted from the body at the (continuous) rate of 20 % per hour. Initially there is no drug in the body. Find the amount of the drug in the body for all times t.

(4b) How long does it take for the amount of the drug in the body to reach 90 % of its limiting value?

(5a) Barium-140 has a half life of 13 days. If you have an atom of Ba-140 at day 0, what is the probability that it will decay some time between day 6 and day 13?

(5a) What is the probability that it does not decay before 20 days?

(5c) What is the expected lifetime of the atom of Ba-140, and what is the standard deviation of its lifetime.

M145 Assignment VIII Due Tue, Feb 28, 2006

Sections	topic	page	Problems
27	Normal Distribution	294	19, 22, 23, 24, 27
Handout	Normal Distribution	-	

Additional assigned problems

(1a) The length of rattlesnakes is normally distributed, with a mean of 1.2 meters, and a standard deviation of .14 meters. What fraction of rattlesnakes have a body length between .9 and 1.3 meters?

(1b) What fraction have a body length of less that .8 meters?

(2a) The masses of birds in a flock of adult chickadees is normally distributed, with a mean of 13.5 grams and a standard deviation of .85 grams. What fraction of the chickadees have a mass of less than 15 grams?

(2b) What fraction of the chickadees have a mass that lies within 2 grams of the mean?

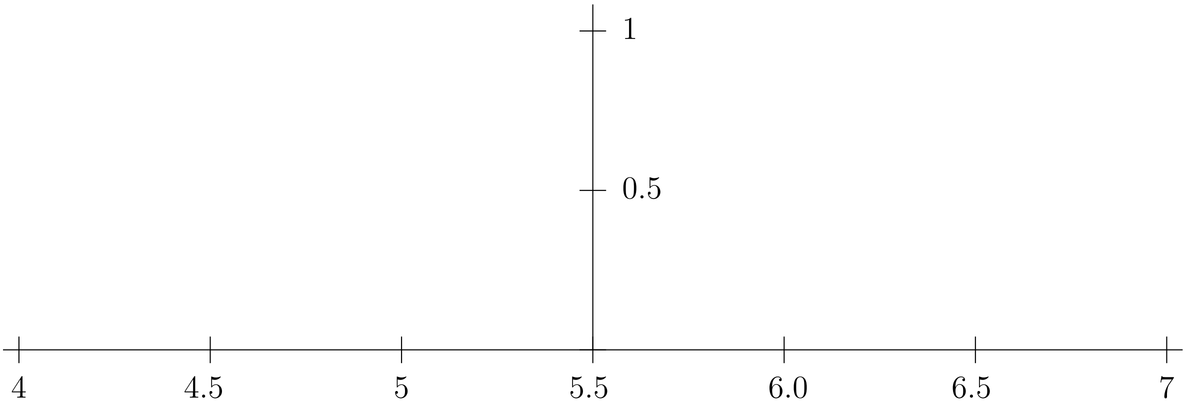
For questions 3 – 4, use the normal approximation for binomial probabilities.

(3) For the offspring of a heterozygous smooth pea plant that is self-pollinated, each plant has a .75 probability of being smooth, and a .25 probability of being wrinkled. If you select 100 plants at random from the offspring, what is the probability that at least 70 and at most 80 are smooth? (Answer: .796)

(4) You take a multiple choice test with 50 questions, and 4 choices on each question. If you choose the answer to each question at random, what is the probability of getting 15 or more questions correct? (Answer: .2568)

M145 Worksheet #08a for Tue, Feb 28, 2006

(1) The lengths of worms in a certain population is normally distributed, with a mean of 5.5 cm and a standard deviation of 0.5 cm. Let $F(x)$ be the probability density function for these lengths. Sketch $F(x)$ and sketch the region which represents the fraction of the worms that have a length between 6 cm and 6.5 cm.



Place the points corresponding to $F(4)$, $F(4.5)$, $F(5)$, $F(5.5)$, $F(6.0)$, $F(6.5)$, $F(7)$ as accurately as you can. Note: for the function $f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$, some values are

$f(\pm 3) \approx 0.004$ $\quad f(\pm 2) \approx 0.054$ $\quad f(\pm 1) \approx 0.24$ $\quad f(0) \approx .4$

(2) A pea has a .7 probability of being smooth, and a .3 probability of being wrinkled. If you select 100 peas at random, what is the probability that at least 65 and at most 75 are smooth? (Use the histogram correction)

(3) The heights of planta are normally distributed with a mean of 10 cm. 80% of them are shorter than 11.68 cm. What is the probability that the height of a plant is between 8 and 12 cm? Suggestion: First use the table to find the value for z with $\Phi(z) = .80$. This value of z is related to σ by $z \cdot \sigma = 1.68$. Calculate σ. Then use the table again to calculate $P(8 < X < 12)$.

(4a) It is known that 37% percent of rats carry the plague. If you select 40 rats at random, what is the probability that 12 or fewer of them are carriers?

(4b) What is the probability that at least 15 and at most 25 of them are carriers?

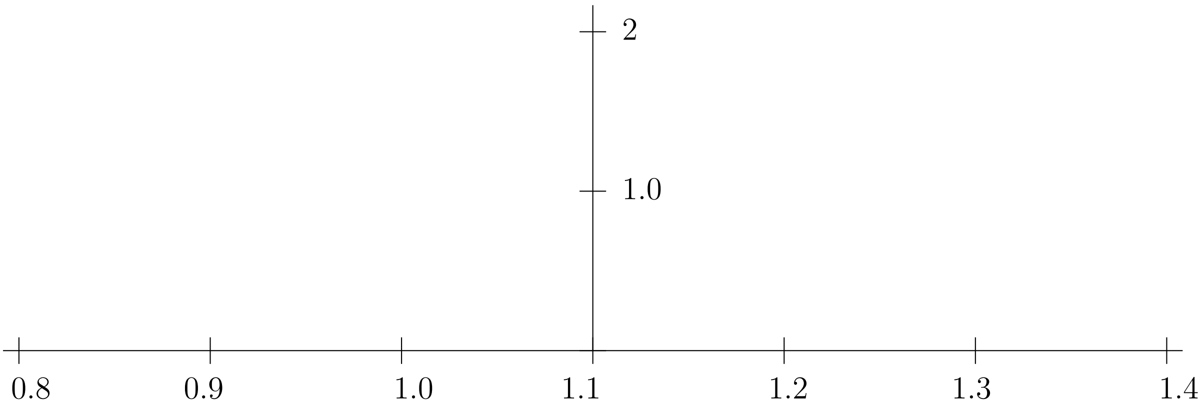
M145 Worksheet #08b for Tue, Feb 28, 2006

(1) Show that, if a quantity X is normally distributed, then the probability that X is within 2 standard deviations of the mean, that is, $P(\mu - 2\sigma < X < \mu + 2\sigma)$, does not depend on the values for μ or σ. (Hint: express the answer using $\Phi(z)$.) What is this probability?

(2) Using the table of values for $\Phi(z)$, what is the probability that X is within 3 standard deviations of the mean? (Answer: .9973)

(3a) The lengths of salmon is normally distributed, with a mean of 1.1 meters, and a standard deviation of 0.2 meters. If a large number of salmon are examined, what fraction of them have a length between 1.0 and 1.3 meters?

(3b) Let $F(x)$ be the probability density function for **(3a)**. Sketch $F(x)$ and sketch the region which represents the fraction of the individuals of **(3a)** that have a length between 1 cm and 1.3 cm.



(4a) In the human population, the probability of a child being male is .52, and the probability of being female is .48. If you take a random sample of 100 children, what is the probability that the sample is between 51% and 53% male?

(4b) Answer the same question for a random sample of 10,000 children.

M145 Assignment IX Due Tue March 7, 2006

Sections	topic	page	Problems
Handout	Poisson Distribution	-	

Additional assigned problems

Use the Poisson approximation for binomial probabilities of rare events.

(1) In the US population, a certain disease occurs in 1.2% of the population. In a sample of 100 people, what is the probability that 0 of them have the disease?

What is the probability that at most 3 of them have the disease?

(2) 100 buses are scheduled to arrive in Seattle during the hour from 1 pm to 2 pm. (Assume each bus arrives at a random time, independent of the other buses.) What is the probability that at most 3 buses arrive during the first minute?

What is the probability that 4 or more buses arrive during the first minute?

(3) A computer chooses 500 random numbers between 0 and 1. What is the probability that 3 or more of them lie between .50 and .51?

(4) A fly trap catches 1000 flies during a 24 hour period. (Assume each fly wanders into the trap at a random time, independent of the other flies.) What is the probability that 4 or more flies are caught during the two minute period between 4:00 and 4:02 pm?

M145 Worksheet #09a for Tue, March 7, 2006

(1) In the US population, a certain disease occurs in 1.5% of the population. In a sample of 100 people, what is the probability that two or more people have the disease?

(2) A scatter-plot is 10 meters by 10 meters, divided into 100 squares, each 1 meter by one meter. 300 seeds are scattered into the plot at random. What is the probability that a given square has exactly 3 seeds? At most 2 seeds?

(3) A fly trap catches an average of 1000 flies during each 24 hour period. What is the probability that 2 or more flies are caught during the 6 minute period between 4:00 and 4:06 pm?

(4) A swithchboard receives an average of 180 calls per hour. What is the probability that it receives 3 or more calls in the next minute?

(5a) What is $\lim_{n\to\infty}\left(1+\frac{2.5}{n}\right)^n$?

(5b) What is $\lim_{n\to\infty}\left(1-\frac{0.5}{n}\right)^n$?

(5c) What is $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^{2n}$?

M145 Worksheet #09b for Tue, March 7, 2006

(1) A pair of dice is rolled 100 times. What is the probability that you roll $\{6,6\}$ two times or more? (Use the Poisson approximation.)

(2) In the US population, a certain disease occurs in 2% of the population. In a sample of 100 people, what is the probability that exactly two of them have the disease?

(3) There is a row 200 yards long, into which 500 seeds are scattered at random. What is the probability that exactly 3 seeds land in the first yard? What is the probability that 3 or more seeds land in the first yard?

(4a) What is $\lim_{n\to\infty}\left(1-\frac{1}{n}\right)^n$?

(4b) What is $\lim_{n\to\infty}\left(1-\frac{0.5}{n}\right)^{3n}$?

(4c) What is $\lim_{n\to\infty}\left(1+\frac{2}{n}\right)^n$?

M145 Worksheet #10 for Sat, March 11, 2006

(1) A fair die is tossed 180 times. What is the probability that the number 6 appears 29, 30, 31 or 32 times?

(2) In a population, there are two blood tupes A and B. The probability of A is .64; the probability of B is .36 If you select 25 memmbers at random, what is the probability that the number of type A is 15, 16, 17 or 18? (Use the histogram correction)

(3) The heights of plants are normally distributed. Half of the plants are shorter than 50 cm, and 85% of them are shorter than 55.7 cm. What fraction are shorter than 52 cm?

(4) The amount of bacteria $y(t)$ in grams at time t in days; $y(t)$ satisfies the logistic differential equation.

$$\frac{dy}{dt} = 0.1y(10 - y)$$

with $y(0) = 20$ The solution is $y(t) = \dfrac{10}{1 + 4e^{-.1t}}$

What are the values of y and t for which the growth rate of y is a maximum, and what is this maximum rate of growth?

(5a) Strontium-80 has a half life of 1.77 hours. If you have an atom of Sr-80 at 12 noon, what is the probability that it will decay some time between 1 PM and 2 PM??