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Question 1

Given the demand curve $p = 40 - 2q^2$ and the supply curve $p = 3 + 5q^2,$ find the producer surplus when the market is in equilibrium.

- 28
- 41
- 40
- 32

Question 2

Find the average value of the function $f(x) = e^x$ between $x = 0$ and $x = 0.1.$

Question 3

Using the Fundamental Theorem evaluate the definite integral below. $\int_0^1 1000e^{-2t}dt$

- $500(1 - e^{-2})$
- $2000(1 - e^{-2})$
- $500(e^{-2} - 1)$
- $500(1 + e^{-2})$

Question 4

Find the derivative of the following function. $y = x\ln x$

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

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Question 5

The cost to produce q items is $C(q) = 2000 + 27q^2$ dollars. Find the marginal cost to produce the 25th item.

- ◯ $1450/item
- ◯ $1350/item
- ◯ $1400/item
- ◯ $1300/item

Question 6

The rate of population growth of Tokyo grew at a linear rate from 0.33 million/year in 1970 to 0.45 million/year in 1990. Estimate the total change in population between 1970 and 1990.

- ◯ 780,000
- ◯ 430,000
- ◯ 330,000
- ◯ 7,800,000

Question 7

Find the value of k such that $f(x) = x^2 e^{kx}$ has a critical point at x=2.

- ◯ -2
- ◯ 0
- ◯ 1
- ◯ -1

Question 8

Determine whether or not the following function is a power function. $y = 2\left(x^2\right)^3$

- ◯ Yes
- ◯ No

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Question 9

Find the derivative of the following function. $y = (x^2 + 2)^5$

- $y' = 10x(x^2 + 2)^4$
- $y' = 10(x^2 + 2)^4$
- $y' = 5x(x^2 + 2)^4$
- $y' = 5(x^2 + 2)^4$

Question 10

Find the equation of the tangent line to $f(x) = e^x$ at the point where $x = 1.$

- $y = -ex$
- $y = -ex + 1$
- $y = ex$
- $y = ex - 1$

Question 11

Let $C(q)$ represent the cost of producing q items. Suppose that $C(100) = 1200$ and that $C'(100) = 15.$ Estimate the total cost in producing 105 items.

- $1275
- $1950
- $1215
- $1590

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Question 12

Find the following indefinite integral. $\int x\sqrt{x^2+4}dx$

- $\frac{1}{3}\left(4+x^2\right)^{1/2}+C$
- $\frac{1}{3}\left(4+x^2\right)^{-1/2}+C$
- $\frac{1}{3}\left(4+x^2\right)^{3/2}+C$
- $\frac{1}{2}\left(4+x^2\right)^{3/2}+C$

Question 13

A city's population is 100,000 and is falling at a continuous rate of 3%. When will the population have halved?

Approximately [ ] years.

Question 14

Find the inflection points of $f(x)=2x^4+8x^3+3$.

- $x=0, x=-2$
- $x=1, x=-1$
- $x=-1, x=-9$
- There are no inflection points.

Question 15

How long would you have to leave $50,000 in a bank account yielding 2% interest compounded continuously to have a balance of $65,000?

- ◯ 10.25 years
- ◯ 12 years
- ◯ 11.33 years
- ◯ 13.12 years

Question 16

Find the integral.

Find the following indefinite integral. $\int xe^{x^2}dx$

- ◯ $e^{x^2}+C$
- ◯ $\frac{1}{2}e^{x^3}+C$
- ◯ $\frac{1}{2}e^{x^2}+C$
- ◯ $2e^{x^2}+C$

Question 17

At a price of $10, a theater can sell all 1500 tickets for a performance. For every $1 increase in the ticket price the number of people buying tickets decreases by 50. What ticket price maximizes revenue?

- ◯ $15
- ◯ $5
- ◯ $20
- ◯ $10

Question 18

The table below gives the revenues (in billions of dollars), *R*, of General Motors, the world's largest auto manufacturer.

Year	1999	2000	2001	2002	2003	2004
R	176.6	183.3	177.3	177.3	185.5	193.0

Find the average rate of change in revenues between 2000 and 2004.

- ◯ $9.7 billion
- ◯ $2.425 billion/year
- ◯ $2.425 billion
- ◯ $9.7 billion/year

Question 19

If you deposit $20,000 into an account earning interest at 7% annual rate compounded annually, how much money is in the account after four years?

- ◯ $167042
- ◯ $2626
- ◯ $26216
- ◯ $262159

Question 20

Find the following indefinite integral. $\int 3x^2\left(1+x^3\right)^5 dx$

- ◯ $x^3\left(1+x^3\right)^6 + C$
- ◯ $\left(1+x^3\right)^6 + C$
- ◯ $\frac{1}{3}\left(1+x^6\right)^3 + C$
- ◯ $\frac{1}{6}\left(1+x^3\right)^6 + C$

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Question 21

A cell phone company charges a monthly fee of $30 plus $0.04 per minute. Find a formula for the monthly charge *C,* in dollars, as a function of the number of minutes, *m*, the phone is used during the month.

- $C = 30(0.04)m$
- $m = 30 + 0.04C$
- $C = 0.04 + 30m$
- $C = 30 + 0.04m$

Question 22

Find all of the critical points of $f(x) = 3x^3 - x + 5$. List them from smallest to largest, separated by commas.

- -3,1
- -1,1
- -1,3
- -1/3,1/3

Question 23

The quantity of a drug, *Q* mg, present in the body *t* hours after a tablet is taken is given by $Q = f(t) = 200te^{-0.25t}$. Find $f'(3)$.

- -23.6183 mg/hour
- 2.3618 mg/hour
- 23.6183 mg/hour
- 23.6183 mg

Question 24

A company producing chairs has fixed costs of $8000 and variable costs of $100 per chair. The company sells the chairs for $300. Find formulas for the cost and revenue functions and use them to find the number of customers at the break-even point.

- 400
- 4000
- 4
- 40

Question 25

The following table gives the emissions, E, of nitrogen oxides in millions of metric tons per year in the US. Let t be the number of years since 1970 and E=f(t). Estimate the total emissions between 1980 and 2000.

Year	1970	1975	1980	1985	1990	1995	2000
E	26.9	26.4	27.1	25.8	25.2	25.0	22.6

- ◯ 744.25 million metric tons
- ◯ 74.4 million metric tons
- ◯ 37.2 million metric tons/year
- ◯ 504 million metric tons