AP Calculus - Review of AB Name ______________

1) To the nearest dollar, how much must a 25 year old invest now at 8% to have \$40000 at age 60?
$A = Pe^{rt}$ (looks like $y = y_0 e^{kt}$).

2) $\frac{dy}{dx} = y$ is a family of A) parabolas B) straight lines C) hyperbolas D) ellipses E) exponentials ______

3) A solution of the differential equation $y\,dy = x\,dx$ could be
A) $x^2 - y^2 = 4$
B) $x^2 + y^2 = 4$
C) $y^2 = 4x^2$
D) $x^2 - 4y^2 = 0$.
E) $x^2 + y^2 = 9$
______

4) An element has a half-life of 22 years, How long will it take for 10% of the original amount to be left,

5) The population of a city increases proportionally to the population at that time. If the city has 20000 in 2000 and 40000 in 2016

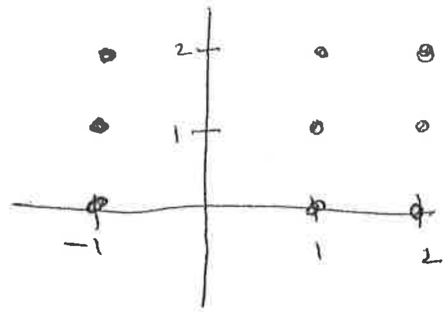
A) How many would you expect in 2032?

B) In what year would you expect the population to hit 50000

6) A cup of coffee at 180°F is placed on a table in a 68°F room. If $\frac{dy}{dt} = -.11(y-68)$, the temperature of the coffee in 10 minutes is (in °F)
A) 96 B) 100 C) 105 D) 110 E) 115 ______

7) Given $\frac{dy}{dt} = .045y$ and at $t=0$ $y=1000$, find y to the nearest integer at $t=10$

8) Given $\frac{dy}{dx} = \frac{y-1}{x^2}$ where $x \neq 0$



A) Draw the slope field at the dots only.

B) Find $y = f(x)$ given $f(2) = 0$ Allow $y_0 = e^c$

9) If $\frac{dh}{dt} = -\frac{1}{5}\sqrt{h}$ Write h as a function of t given $h = 17$ at $t = 0$.

10) $\frac{dG}{dt} = -.056G$ If $G = 2000$ at $t = 0$ find G at $t = 40$.

Student Name: ______________________ Score:

Answers

1. $(2p^3 + 5p^2 - 4) \times (3p + 1)$ $= \mathbf{6p^4 + 17p^3 + 5p^2 - 12p - 4}$

2. $(p^2 + 5p + 2) \times (3p^2 + p)$ $= \mathbf{3p^4 + 16p^3 + 11p^2 + 2p}$

3. $(q^4 - 3q^3 + 1) \times (-q^2)$ $= \mathbf{-q^6 + 3q^5 - q^2}$

4. $(-s^2 + 5) \times (s^3 - 7)$ $= \mathbf{-s^5 + 5s^3 + 7s^2 - 35}$

5. $(2s + 3) \times (s^2 + 4s + 3)$ $= \mathbf{2s^3 + 11s^2 + 18s + 9}$

6. $(x^3 + 2x^2) \times (7x + 4)$ $= \mathbf{7x^4 + 18x^3 + 8x^2}$

7. $(t^2 - 3t + 5) \times (t - 1)$ $= \mathbf{t^3 - 4t^2 + 8t - 5}$

8. $(5y^2 - 3) \times (y^3 + 2)$ $= \mathbf{5y^5 - 3y^3 + 10y^2 - 6}$

9. $(p^4 + 3p^2 - 8) \times (p + 1)$ $= \mathbf{p^5 + p^4 + 3p^3 + 3p^2 - 8p - 8}$

10. $(-t^3 + 3t) \times (-3t^2 + 2t)$ $= \mathbf{3t^5 - 2t^4 - 9t^3 + 6t^2}$

Student Name: ____________________ **Score:**

Multiply the polynomials

1. $(2p^3 + 5p^2 - 4) \times (3p + 1)$ = ____________________

2. $(p^2 + 5p + 2) \times (3p^2 + p)$ = ____________________

3. $(q^4 - 3q^3 + 1) \times (-q^2)$ = ____________________

4. $(-s^2 + 5) \times (s^3 - 7)$ = ____________________

5. $(2s + 3) \times (s^2 + 4s + 3)$ = ____________________

6. $(x^3 + 2x^2) \times (7x + 4)$ = ____________________

7. $(t^2 - 3t + 5) \times (t - 1)$ = ____________________

8. $(5y^2 - 3) \times (y^3 + 2)$ = ____________________

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Student Name: ______________________ Score:

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Student Name: ______________________ **Score:**

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10. $(-t^3 + 3t) \times (-3t^2 + 2t)$ = ____________________

CALCULUS AB

SECTION II, Part A

Time—30 minutes

Number of problems—2

A graphing calculator is required for these problems.

t (hours)	0	1	3	6	8
$R(t)$ (liters / hour)	1340	1190	950	740	700

1. Water is pumped into a tank at a rate modeled by $W(t) = 2000e^{-t^2/20}$ liters per hour for $0 \le t \le 8$, where t is measured in hours. Water is removed from the tank at a rate modeled by $R(t)$ liters per hour, where R is differentiable and decreasing on $0 \le t \le 8$. Selected values of $R(t)$ are shown in the table above. At time $t = 0$, there are 50,000 liters of water in the tank.

(a) Estimate $R'(2)$. Show the work that leads to your answer. Indicate units of measure.

(b) Use a left Riemann sum with the four subintervals indicated by the table to estimate the total amount of water removed from the tank during the 8 hours. Is this an overestimate or an underestimate of the total amount of water removed? Give a reason for your answer.

(c) Use your answer from part (b) to find an estimate of the total amount of water in the tank, to the nearest liter, at the end of 8 hours.

(d) For $0 \le t \le 8$, is there a time t when the rate at which water is pumped into the tank is the same as the rate at which water is removed from the tank? Explain why or why not.

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2. For $t \geq 0$, a particle moves along the x-axis. The velocity of the particle at time t is given by $v(t) = 1 + 2\sin\left(\frac{t^2}{2}\right)$. The particle is at position $x = 2$ at time $t = 4$.

   (a) At time $t = 4$, is the particle speeding up or slowing down?

   (b) Find all times t in the interval $0 < t < 3$ when the particle changes direction. Justify your answer.

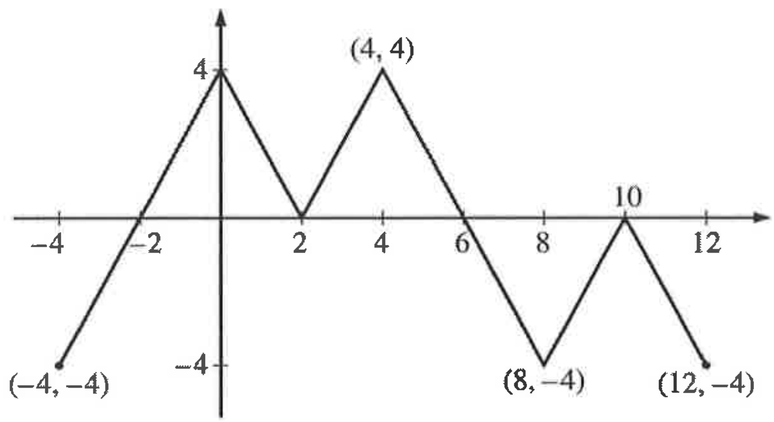
   (c) Find the position of the particle at time $t = 0$.

   (d) Find the total distance the particle travels from time $t = 0$ to time $t = 3$.

END OF PART A OF SECTION II

CALCULUS AB
SECTION II, Part B
Time—60 minutes
Number of problems—4

No calculator is allowed for these problems.



Graph of f

3. The figure above shows the graph of the piecewise-linear function f. For $-4 \le x \le 12$, the function g is defined by $g(x) = \int_2^x f(t)\,dt$.

(a) Does g have a relative minimum, a relative maximum, or neither at $x = 10$? Justify your answer.

(b) Does the graph of g have a point of inflection at $x = 4$? Justify your answer.

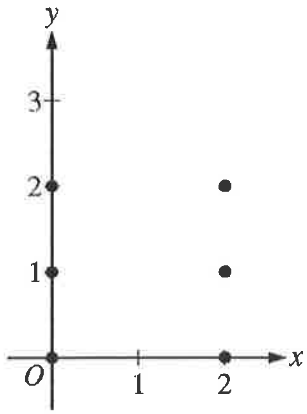
(c) Find the absolute minimum value and the absolute maximum value of g on the interval $-4 \le x \le 12$. Justify your answers.

(d) For $-4 \le x \le 12$, find all intervals for which $g(x) \le 0$.

GO ON TO THE NEXT PAGE.

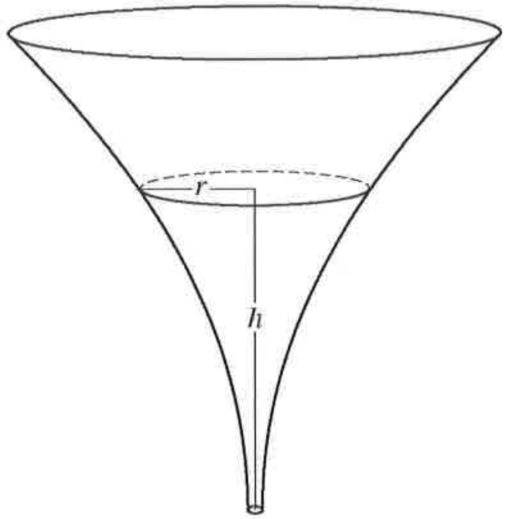
4. Consider the differential equation $\frac{dy}{dx} = \frac{y^2}{x-1}$.

(a) On the axes provided, sketch a slope field for the given differential equation at the six points indicated.



(b) Let $y = f(x)$ be the particular solution to the given differential equation with the initial condition $f(2) = 3$. Write an equation for the line tangent to the graph of $y = f(x)$ at $x = 2$. Use your equation to approximate $f(2.1)$.

(c) Find the particular solution $y = f(x)$ to the given differential equation with the initial condition $f(2) = 3$.



5. The inside of a funnel of height 10 inches has circular cross sections, as shown in the figure above. At height h, the radius of the funnel is given by $r = \frac{1}{20}\left(3 + h^2\right)$, where $0 \le h \le 10$. The units of r and h are inches.

   (a) Find the average value of the radius of the funnel.

   (b) Find the volume of the funnel.

   (c) The funnel contains liquid that is draining from the bottom. At the instant when the height of the liquid is $h = 3$ inches, the radius of the surface of the liquid is decreasing at a rate of $\frac{1}{5}$ inch per second. At this instant, what is the rate of change of the height of the liquid with respect to time?

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x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	−6	3	2	8
2	2	−2	−3	0
3	8	7	6	2
6	4	5	3	−1

6. The functions f and g have continuous second derivatives. The table above gives values of the functions and their derivatives at selected values of x.

   (a) Let $k(x) = f(g(x))$. Write an equation for the line tangent to the graph of k at $x = 3$.

   (b) Let $h(x) = \dfrac{g(x)}{f(x)}$. Find $h'(1)$.

   (c) Evaluate $\int_1^3 f''(2x)\,dx$.

STOP

END OF EXAM