AP Calculus AB Name: __________________________

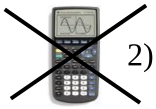
Exam Review Sheet A - Session 1

1) A container has the shape of an open right circular cone. The height of the container is 10 cm and the diameter of the opening is 10 cm. Water in the container is evaporating so that its depth h is changing at the constant rate of $-\dfrac{3}{10}$ cm/hr. (The volume of a cone is $V = \dfrac{1}{3}\pi r^2 h$.)

a) Find the volume V of water in the container when $h = 5$ cm. Indicate units of measure.

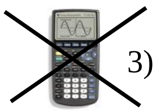
b) Find the rate of change of the volume of water in the container, with respect to time, when $h - 5$ cm. Indicate units of measure.

c) Show that the rate of change of the volume of water in the container due to evaporation is directly proportional to the exposed surface area of the water. What is the constant of proportionality?



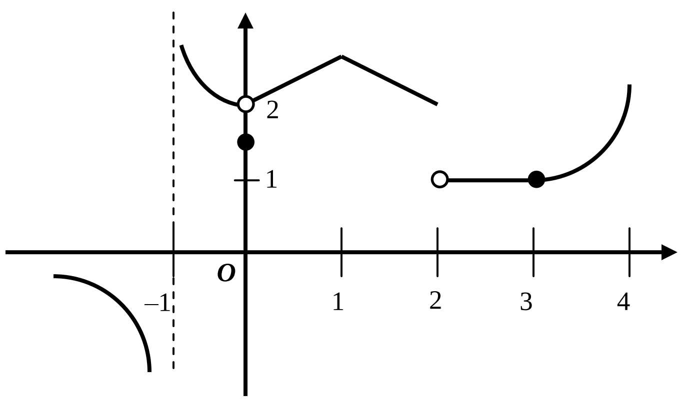
2) What is $\lim_{h\to 0}\dfrac{\cos\left(\dfrac{3\pi}{2}+h\right)-\cos\left(\dfrac{3\pi}{2}\right)}{h}$?

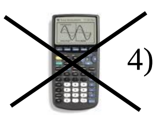
$a)$ 1 $\qquad b)$ $\dfrac{\sqrt{2}}{2}$ $\qquad c)$ 0 $\qquad d)$ -1 $\qquad e)$ The limit does not exist.



3) What is $\lim_{x\to\infty}\dfrac{x^2-4}{2+x-4x^2}$?

$a)$ -2 $\qquad b)$ $-\dfrac{1}{4}$ $\qquad c)$ $\dfrac{1}{2}$ $\qquad d)$ 1 $\qquad e)$ The limit does not exist.



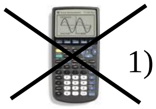


4) The graph of a function f is shown above. If $\lim_{x\to b} f(x)$ exists and f is not continuous at b, then b =

$a)$ -1 $\qquad b)$ 0 $\qquad c)$ 1 $\qquad d)$ 2 $\qquad e)$ 3

AP Calculus AB
Exam Review Sheet A - Session 2

Name: ____________________________



1) Consider the curve given by $x^2 + 4y^2 = 7 + 3xy$.

a) Show that $\frac{dy}{dx} = \frac{3y - 2x}{8y - 3x}$

b) Show that there is a point P with x-coordinate 3 at which the line tangent to the curve at P is horizontal. Find the y-coordinate of P.

c) Find the value of $\frac{d^2y}{dx^2}$ at the point P found in part (b). Does the curve have a local maximum, a local minimum, or neither at the point P? Justify your answer.

2) If $f'(x) = \sin\left(\frac{\pi e^x}{2}\right)$ and $f(0) = 1$, then $f(2) =$

$a)\ -1.819$ $b)\ -0.843$ $c)\ -0.819$ $d)\ 0.157$ $e)\ 1.157$

3) The solution to the differential equation $\frac{dy}{dx} = \frac{x^3}{y^2}$, where $y(2) = 3$, is

$a)\ y = \sqrt[3]{\frac{3}{4}x^4}$ $b)\ y = \sqrt[3]{\frac{3}{4}x^4} + \sqrt[3]{15}$ $c)\ y = \sqrt[3]{\frac{3}{4}x^4} + 15$

$d)\ y = \sqrt[3]{\frac{3}{4}x^4 + 5}$ $e)\ y = \sqrt[3]{\frac{3}{4}x^4 + 15}$

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x	1.1	1.2	1.3	1.4
$f(x)$	4.18	4.38	4.56	4.74

4) Let f be a function such that $f''(x) < 0$ for all x in the closed interval [1, 2]. Selected values of f are shown in the table above. Which of the following must be true about $f'(1.2)$?

$a)\ f'(1.2) < 0$ $b)\ 0 < f'(1.2) < 1.6$ $c)\ 1.6 < f'(1.2) < 1.8$
$d)\ 1.8 < f'(1.2) < 2.0$ $e)\ f'(1.2) > 2.0$

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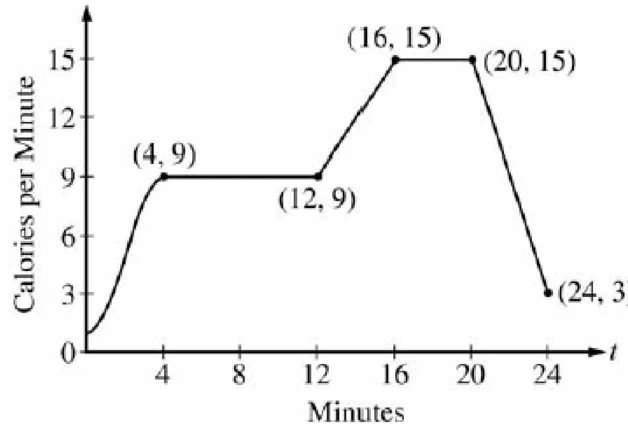
Exam Review Sheet A - Session 3

1)

Question 4

The rate, in calories per minute, at which a person using an exercise machine burns calories is modeled by the function f. In the figure above, $f(t) = -\frac{1}{4}t^3 + \frac{3}{2}t^2 + 1$ for $0 \le t \le 4$ and f is piecewise linear for $4 \le t \le 24$.



(a) Find $f'(22)$. Indicate units of measure.

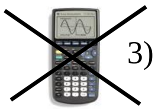
(b) For the time interval $0 \le t \le 24$, at what time t is f increasing at its greatest rate? Show the reasoning that supports your answer.

(c) Find the total number of calories burned over the time interval $6 \le t \le 18$ minutes.

(d) The setting on the machine is now changed so that the person burns $f(t) + c$ calories per minute. For this setting, find c so that an average of 15 calories per minute is burned during the time interval $6 \le t \le 18$.

2) Oil is leaking from a tanker at the rate of $R(t) = 2,000e^{-0.2t}$ gallons per hour, where t is measured in hours. How much oil leaks out of the tanker from time t = 0 to t = 10?

a) 54 gallons *b)* 271 gallons *c)* 865 gallons
d) 8,647 gallons *e)* 14,778 gallons

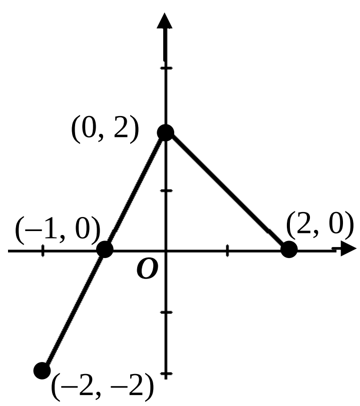


3) $\int (x-1)\sqrt{x}dx =$

$a)\ \frac{3}{2}\sqrt{x} - \frac{1}{\sqrt{x}} + C$ $b)\ \frac{2}{3}x^{\frac{3}{2}} + \frac{1}{2}x^{\frac{1}{2}} + C$ $c)\ \frac{1}{2}x^2 - x + C$

$d)\ \frac{2}{5}x^{\frac{5}{2}} - \frac{2}{3}x^{\frac{3}{2}} + C$ $e)\ \frac{1}{2}x^2 + 2x^{\frac{3}{2}} - x + C$

4)



Graph of f

The graph of the function f shown above consists of two line segments. If g is the function defined by $g(x) = \int_0^x f(t)dt$, then $g(-1) =$

$a) -2$ $b)\ -1$ $c)\ 0$ $d)\ 1$ $e)\ 2$

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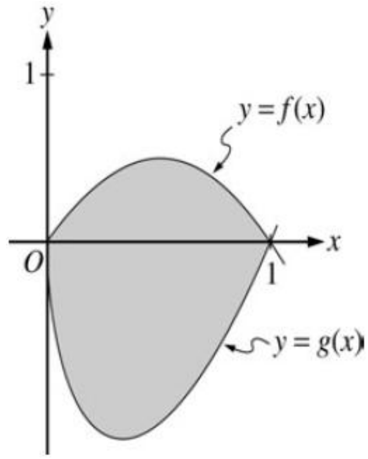
Exam Review Sheet A - Session 4

1)



Let f and g be the functions given by $f(x) = 2x(1-x)$ and $g(x) = 3(x-1)\sqrt{x}$ for $0 \le x \le 1$. The graphs of f and g are shown un the figure above.

a) Find the area of the shaded region enclosed by the graphs of f and g.

b) Find the volume of the solid generated when the shaded region enclosed by the graphs of f and g is revolved about the horizontal line $y = 2$.

c) Let h be the function given by $h(x) = kx(1-x)$ for $0 \le x \le 1$. For each $k > 0$, the region (not shown) enclosed by the graphs of h and g is the base of a solid with square cross sections perpendicular to the x-axis. There is a value of k for which the volume of this solid is equal to 15. Write, but to not solve, an equation involving an integral expression that could be used to find the value of k.

2) Let S be the region enclosed by the graphs of $y=2x$ and $y=2x^2$ for $0\le x\le 1$. What is the volume of the solid generated when S is revolved about the line $y = 3$?

$a)\ \pi\int_0^1 \left[(3-2x^2)^2-(3-2x)^2\right]dx$

$b)\ \pi\int_0^1 \left[(3-2x)^2-(3-2x^2)^2\right]dx$

$c)\ \pi\int_0^2 \left(4x^2-4x^4\right)dx$

$d)\ \pi\int_0^2\left(\left(y-\frac{y}{2}\right)^2-\left(3-\sqrt{\frac{y}{2}}\right)^2\right)dy$

$e)\ \pi\int_0^2\left(\left(3-\sqrt{\frac{y}{2}}\right)^2-\left(3-\frac{y}{2}\right)^2\right)dy$

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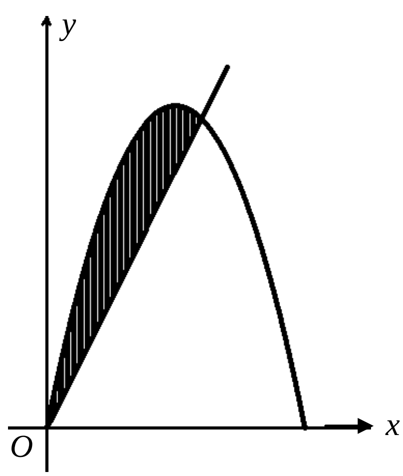
3) The base of a solid S is the semicircular region enclosed by the graph of $y=\sqrt{4-x^2}$ and the x-axis. If the cross sections of S perpendicular to the x-axis are squares, then the volume of S is

$a)\ \frac{32\pi}{3}$ $\quad b)\ \frac{16\pi}{3}$ $\quad c)\ \frac{40}{3}$ $\quad d)\ \frac{32}{3}$ $\quad e)\ \frac{16}{3}$



4) The figure above shows the graph of $y=5x-x^2$ and the graph of the line $y=2x$. What is the area of the shaded region?

$a)\ \frac{25}{6}$ $\quad b)\ \frac{9}{2}$ $\quad c)\ 9$ $\quad d)\ \frac{27}{2}$ $\quad e)\ \frac{45}{2}$

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Exam Review Sheet A - Session 5

1) A particle moves along the y-axis so that its velocity v at time $t \geq 0$ is given by $v(t) = 1 - \tan^{-1}(e^t)$. At time $t = 0$, the particle is at $y = -1$.

a) Find the acceleration of the particle at time $t = 2$.

b) Is the speed of the particle increasing or decreasing at time $t = 2$? Give a reason for your answer.

c) Find the time $t \geq 0$ at which the particle reaches its highest point. Justify your answer.

d) Find the position of the particle at time $t = 2$. Is the particle moving toward the origin or away from the origin at time $t = 2$? Justify your answer.

1) Two particles start at the origin and move along the x-axis. For $0 \le t \le 10$, their respective position functions are given by $x_1 = \sin t$ and $x_2 = e^{-2t} - 1$. For how many values of t do the particles have the same velocity?

a) None b) One c) Two d) Three e) Four

2) The position of a particle moving along a line is given by $s(t) = 2t^3 - 24t^2 + 90t + 7$ for $t \ge 0$. For what values of t is the speed of the particle increasing?

a) $3 < t < 4$

b) $t > 4$

c) $t > 5$

d) $0 < t < 3$ and $t > 5$

e) $3 < t < 4$ and $t > 5$

3) Consider a continuous function f with the properties that f is concave up on the interval $[-1, 3]$ and concave down on the interval $[3, 5]$. Which of the following statements is true?

a) $f''(2) > 0$ and $f''(4) < 0$

b) $f''(2) < 0$ and $f''(4) > 0$

c) $f''(3) > 0$ and $x = 3$ is a point of inflection of f

d) Both a and c

e) Both b and c