1. (5 pts) Determine $\cosh(a)$ if $\sinh(a) = 5$.

2. (5 pts) Evaluate and simplify $\tanh(\ln(4))$.

3. (10 pts) For the parametric curve, $x(t) = 3\sin(t)$ and $y(t) = 8\cos(t)$, determine the equation of the tangent line when $t = \dfrac{\pi}{3}$.

4. (5 pts) If $g(x) = \displaystyle\int_2^{x^2} \sin^6(u)\, du$, determine $g'(x)$.

5. (5 pts each) Differentiate the following functions. You do not need to simplify your answer.

(a) $f(x) = \ln(3^x + 2e^{-2x})$

(b) $y = \dfrac{2\sin^3(x)}{1 + x^3}$

(c) $f(x) = \sqrt{1 - 4x^2}\ \arcsin(2x)$

(d) $y = \dfrac{10}{(x^2 + 5x + 1)^2}$

(e) $y = (3x+1)^2 (x^3 - 4x^2 + x - 7)^4$

(f) $y = (2 + \cos(x))^x$

6. For the curve $(1+y^2)^3 + (1+x^2)^3 + 4xy = 20$

(a) (10 pts) Determine $\dfrac{dy}{dx}$

(b) (5 pts) Determine the equation of the tangent line at the point $(1, 1)$.

7. (15 pts) Determine the limit (show all work)

(a) $\lim_{x \to 0} \dfrac{x + 3\sin(2x)}{6\tan(x)}$

(b) $\lim_{x \to 0} (1 + 2x)^{3x}$

(c) $\lim_{x \to \infty} (\ln(4x + 1) - \ln(3x + 2))$

8. (15 pts) A kite 100 ft above the ground moves horizontally at a rate of 8 ft/sec. At what rate is the angle between the string and the horizontal changing when 200 ft of string has been let out?

9. (20 pts) Answer the following for the function $f(x) = \dfrac{x^3}{3 - x^2}$ $\left(f'(x) = \dfrac{9x^2 - x^4}{(3 - x^2)^2}\right)$

(a) (2 pts) State any vertical asymptotes and show them on the graph below.

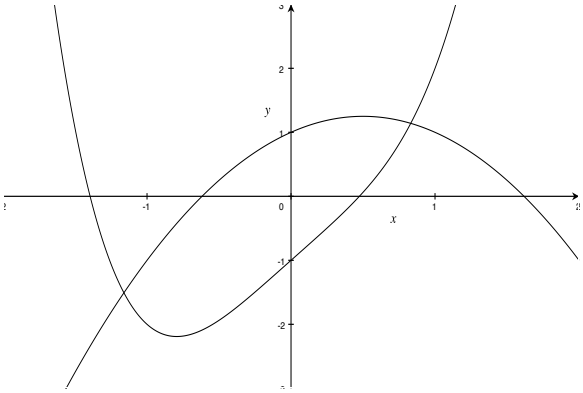
(b) (5 pts) Verify the intervals on which $f(x)$ is increasing and on which $f(x)$ is decreasing.

(c) (5 pts) $\lim_{x \to -\infty} f(x) =$ _____ $\lim_{x \to \infty} f(x) =$ _____

(d) (8pts) Graph the function. Show asymptote(s), intercept(s) and the exact points (x, y) where the function has any horizontal tangents.

10. (15 pts) A farmer wants to build a rectangular shed with vertical walls and horizontal roof. The length of the shed must be twice the width. He needs the shed to be 288 cubic yards. Find the dimensions of the shed that uses the least possible amount of plywood for the walls and the roof. (The base is cement so it does not use any plywood.)

11. (10 pts) Use Newton's Method once to approximate the first postitive value where the functions $f(x) = x^4 + 2x - 1$ and $g(x) = 1 + x - x^2$ intersect.

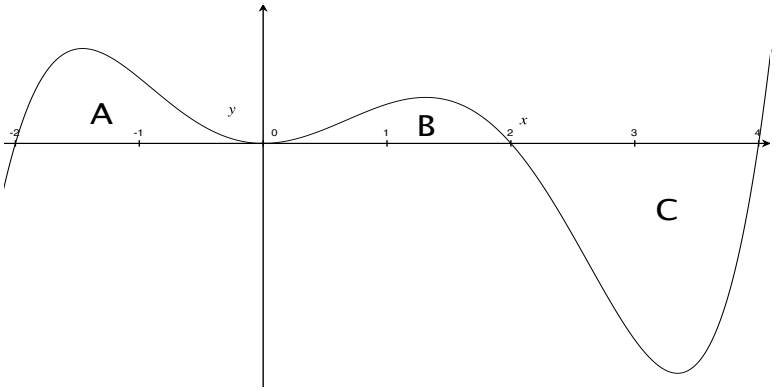


12. (10 pts) Evaluate the following integrals. You may use geometry.

(a) $\int_0^5 \sqrt{25 - x^2}\, dx$

(b) $\int_{-2}^5 |x - 1|\, dx$

13. (15 pts) Below is the plot of $f'(x)$. The area of section(A) is 12. The area of section(B) is 10. The area of section(C) is 18.5.



(a) (7 pts) Sketch a graph of $f(x)$ on $-2 \leq x \leq 4$ such that $f(-2) = 0$. Make sure to show where $f(x)$ has local maximum values, local mininimum values and any changes in concavity.

(b) (2 pts each) Determine the values below.

$f(2) =$ _____ $f(4) =$ _____

$\int_0^2 f'(x)\,dx =$ _____ $\int_0^4 f'(x)\,dx =$ _____

14. (30 pts)Evaluate the following integrals.

(a) $\int_1^4 \left(\frac{4}{x^2} + 3\sqrt{x} - \frac{3}{\sqrt{x}} + 2 \right) dx$ (Simplify answer)

(b) $\int \arcsin(x)\, dx$

(c) $\int \frac{(\ln(x))^3}{x}\, dx$

(d) $\int 4\sin^3(2x)\cos^2(2x)\,dx$

(e) $\int \dfrac{3x}{\sqrt{1-4x^2}}\,dx$

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