# Prince Sultan University

**Math 113**
**Midterm Examination**
**Summer Semester, Term 111**
**Monday, 16th January, 2012**

**Time Allowed: 120 minutes**

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|---|
| Student Name: |
| Student ID #: |

***Important Instructions:***

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be NO talking during the examination.
5. Your exam will be taken immediately if your mobile phone is seen or heard.
6. Looking around or making an attempt to cheat will result in your exam being cancelled.
7. This examination has 11 problems, some with several parts. Make sure your paper has all these problems.

| Problems | Max points | Student's Points |
|---|---|---|
| | | |
| 1,2,3 | 18 | |
| 4,5 | 14 | |
| 6,7 | 12 | |
| 8,9 | 16 | |
| 10 | 30 | |
| 11 | 10 | |
| | | |
| Total | 100 | |

1. (5 points) Find the arc length of $y = \frac{4\sqrt{2}}{3} x^{\frac{3}{2}} - 1$ ;between $x = 0$ and $x = 1$.

2. (5 points) Let $F(x) = \int_5^x \sqrt{3t^2 + 6}\, dt$ , find $F(5)$ , $F'(5)$, and $F''(5)$.

3. (8 points) Evaluate the following integrals:

*i.* $\int \frac{\sqrt{3+\sqrt{x}}}{\sqrt{x}} dx$

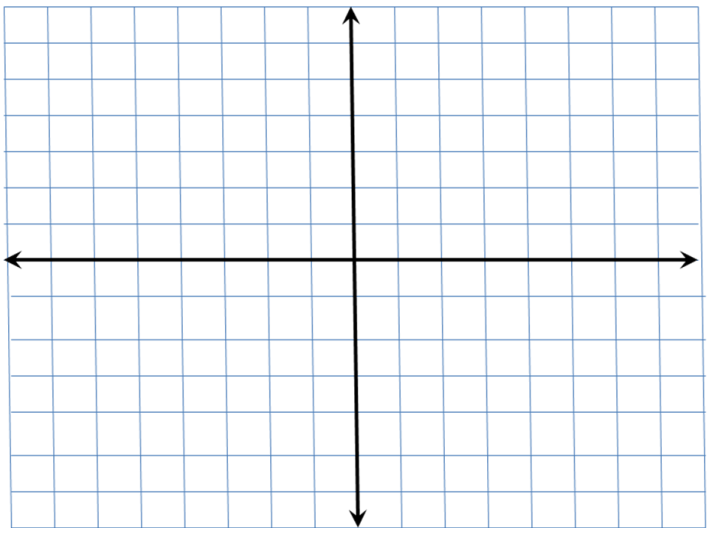
*ii.* $\int \sqrt[3]{e^x} \cdot \sqrt{e^x} \cdot \sinh x \, dx$

4. (8 points) Evaluate the following limits:

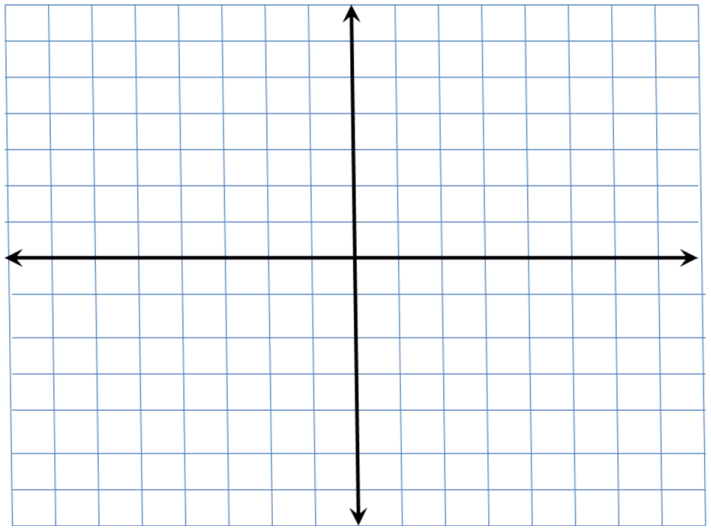
1. $\lim_{x\to 0}\left(\dfrac{\cos x - 1 + \frac{1}{2}x^2}{x^4}\right) =$

2. $\lim_{x\to 0}\left(x+\cos x\right)^{1/x} =$

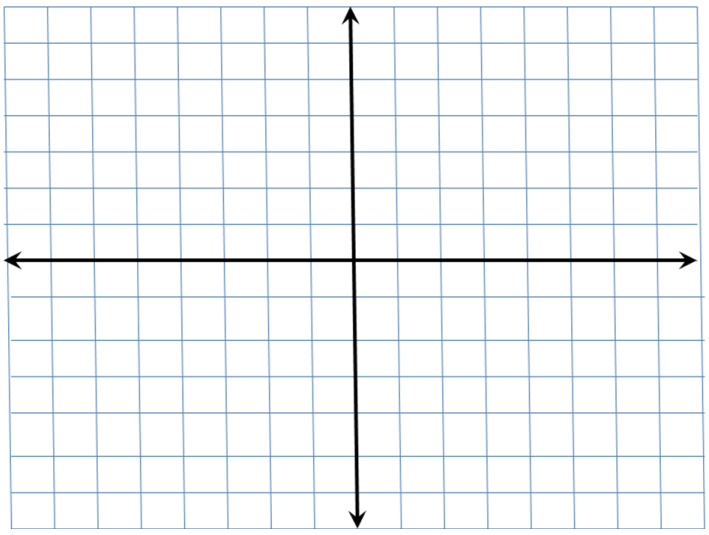
5. (6 points) Sketch the region enclosed by the curves: $y=\sqrt{x}$ , $y=\dfrac{-1}{4}x$ and $x=4$, **then** find the bounded area.



6. (6 points) Find the volume of the solid that results when the region $R$ bounded by the given curves $y=\sqrt{3-x}$ , $x=-1$ and $y=0$ is revolved about the x-axis



7. (6 points) Find the volume of the solid that results when the region $R$ bounded by the given curves $y=x^2$ , $y=x+2$ is revolved about the line $x=3$.



8. (8 points) Use Simpson's Rule with $n = 6$ to estimate $\int_1^4 \sqrt{\ln x}\, dx$

| $x_i$ | $f(x_i)$ | $w$ | $w \cdot f(x_i)$ |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
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| | | | |
| | | | |
| | | Total | |

9. (8 points) Determine whether the following integrals converge or diverge. **(<u>Show all your steps</u>)**.

1. $\int_0^1 \frac{dx}{\sqrt{x}(x+1)}$

2. $\int_0^3 \frac{dx}{x-2}$

10. (30 points) Evaluate the following integrals:

*i.* $\int \sin\left(\sqrt{x}\right) dx$

*ii.* $\int \sin^3 x \cdot \cos^2 x \; dx$

*iii.* $\int \frac{\sqrt{x^2 - 1}}{x} dx$

*iv.* $\int \frac{e^{2x}}{e^{2x} - e^{x} - 6}\, dx$

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

*vi.* $\int \tan x \sec^{4} x\, dx$

11. (10 points) Solve the differential equation by the method of integrating factor:

$$(x^2+3x+2)\cdot\frac{dy}{dx}+xy=x(x+1)$$