

**Question 1:** Let  $f(x) = e^{(2\sqrt{x}+1)}$ . Find a formula for  $f^{-1}(x)$  (you may assume that the given function  $f(x)$  is one-to-one.)

[5]

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**Question 2:** Use logarithmic differentiation to find  $y'$ . Express your answer as a function of  $x$  only:

$$y = (\sin x)^{\ln x}$$

[5]

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**Question 3:**

(a) Determine the exact value of  $\cos^{-1}(\cos(5\pi/3))$

[3]

(b) Find the derivative of  $y = \arctan(\sqrt{\sin(\theta)})$ .

[3]

(c) Find an equation of the tangent line to  $y = \sqrt{1-x^2} \arccos(x)$  at the point where  $x = 0$ .

[4]

Question 4: Evaluate the following limits:

(a)  $\lim_{x \rightarrow 2} \frac{\ln(2x - 3)}{x^2 - 4}$

[3]

(b)  $\lim_{x \rightarrow 0} \frac{2 - x^2 - 2 \cos(x)}{x^4}$

[3]

(c)  $\lim_{x \rightarrow \infty} (e^x + 1)^{1/x}$

[4]

**Question 5:** For this question use  $f(x) = \frac{1}{2}x^2 - 6x + 8 \ln(x)$

(a) Determine the intervals on which  $f$  is increasing or decreasing.

[8]

(b) Determine the local (or relative) maximum and minimum values of  $f$ .

[2]

**Question 6:** For this question use  $f(x) = x - \sin(x)$  on the interval  $[0, 3\pi]$

(a) Determine the intervals of concavity.

[8]

(b) Determine all inflection points.

[2]