

## 1. Answer True or False

(10)

(a)  $\frac{|x| + 3x}{2x} = 2$  when  $x > 0$

(b)  $4^{\frac{3}{2}} - \log_3 81 + e^{2 \ln 2} - \sec^2 \pi = 15$

(c)  $(\sin x + \cos x)^2 - \sin(2x) = 0$

(d)  $f(x) = x^3 \sin x$  is an even function

(e)  $y = |x - 1| - 2$  has x-intercepts  $-1$  and  $3$

(f) The solution to  $2^x = 5$  is  $\ln\left(\frac{5}{2}\right)$

(g) The domain of  $y = \ln(2 - x) = \{x \mid x > 2\}$

(h)  $y = e^x$  is a 1-1 function

(i) A sector with radius 5 cm and central angle  $108^\circ$  has arclength,  $s = 3\pi$  cm

(j) The center for the circle  $x^2 + 4x + y^2 - 6y = 12$  is  $(2, 3)$

2. Given:  $f(x) = 5(2x - 1)^{\frac{3}{2}} - 15(2x - 1)^{\frac{1}{2}}$

(a) Use factoring to write  $f(x)$  as a **single** fraction. (3)

(b) Find the x-intercept. (1)

(c) Find  $f(5)$  (1)

## 3. Solve the following inequalities. Write your answers in interval form.

(a)  $\frac{x^2}{(x - 4)(x + 2)} \geq 0$  (2)

(b)  $|3x - 5| < 2$  (1)

## 4. Given: A(-1, 5) and B(7, 9), find:

(a) equation of the line between the two points. Give  $ax + by + c = 0$  Form (2)

(b) equation of the perpendicular bisector of AB. Give  $y = mx + b$  Form (2)

(c) equation of the line through B and parallel to  $3x - 2y = 5$  (2)

5. Given:  $f(x) = \begin{cases} 4 - x^2 & x \leq 1 \\ \sqrt{x - 1} & x > 1 \end{cases}$  (5)

(a) Sketch the graph of  $f(x)$

(b) Use the graph to find:

(i)  $\lim_{x \rightarrow 1^-} f$  (ii)  $\lim_{x \rightarrow 1^+} f$  (iii)  $\lim_{x \rightarrow 1} f$  (iv)  $\lim_{x \rightarrow 0} f$  (v)  $\lim_{x \rightarrow \infty} f$  (vi)  $\lim_{x \rightarrow -\infty} f$

## 6. Find the following limits:

(a)  $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x^2 - 4}$  (2)

(b)  $\lim_{x \rightarrow 3} \frac{3 - x}{\sqrt{x^2 - 5} - 2}$  (2)

7. If  $f(x) = 5x^2 - 3x + 1$ , then find:

$$(a) \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \quad (2)$$

$$(b) \lim_{x \rightarrow 1} \frac{f(x) - f(1)}{x - 1} \quad (2)$$

8. Use the 3-step method to find  $f^{-1}(x)$  for  $f(x) = \frac{x-1}{x}$ . (3)

9. If  $f(x) = \frac{1}{\sqrt{x-2}}$  and  $g(x) = x^2 - 2x - 1$ , then find  $D_{f \circ g}$  in Interval Notation. (3)

10. Graph the following functions. Indicate any intercepts and asymptotes.

$$(a) y = \frac{2x^2 + 3x - 2}{x + 2}. \text{ First, you must reduce } y \quad (3)$$

$$(b) y = \frac{x^2 + 4x}{(x+2)(x-1)}. \text{ Indicate the point where graph crosses its HA.} \quad (6)$$

$$(c) y = 2^{x+1} - 4. \text{ Indicate the point at } x = 2 \quad (3)$$

$$(d) y = \left| \log_{\frac{1}{2}}(x-2) \right|. \text{ First, graph } \log_{\frac{1}{2}}(x-2) \quad (3)$$

$$(e) y = 2 \cos\left(2x - \frac{\pi}{2}\right). \text{ Indicate Amplitude, period \& Phase Shift} \quad (3)$$

11. Solve the following:

$$(a) 2x^3 + x^2 - 5x + 2 = 0 \text{ Use the Factor Theorem} \quad (3)$$

$$(b) e^{\sqrt{2x-1}-3} = 1 \quad (2)$$

$$(c) \log_4(x+6) - \log_4(x+1) = \log_4(x-2) \quad (3)$$

$$(d) 2 \cos \theta + 1 = 0 \text{ for } 0 \leq \theta < 2\pi \quad (3)$$

12. Express  $y = 4x^2 - 4x + 3$  as  $y = a(x-h)^2 + k$  by completing the square. (2)

13. Prove that  $\frac{\tan^2 x - 1}{\sin x + \cos x} = \frac{\sin x - \cos x}{\cos^2 x}$  (4)

**Draw the appropriate triangles for # 14 to 20 and correct your answers to 2 decimal places**

14. A plane leaves the runway climbing at  $30^\circ$  with a speed of 275 feet per second. Find the altitude,  $h$ , of the plane after one minute. (3)

15. Points A and B are on opposite sides of a river. To find the distance between the points, a third point C is located on the same side of the river as point A. The distance between A and C is 45 feet,  $\angle ACB = 42^\circ$ , and  $\angle BAC = 105^\circ$ . Find the distance between A and B. (3)

16.  $\triangle ABC$  has side  $a = 15$ , side  $b = 13$  and side  $c = 20$ . Find  $\angle A$ . (2)

17. A man standing near a radio station antenna observes that the angle of elevation to the top of the antenna is  $9^\circ$ . He then walks 1300 feet further away from the antenna and observes the angle of elevation to the top of the antenna to be  $3.5^\circ$ . Find the height of the antenna. (4)

18. Find  $\angle C$  for the  $\triangle ABC$  with  $\angle A = 45^\circ$ , side  $a = 25$  and side  $c = 30$ . Indicate the type of solution - no solution, unique solution or two solutions. If there are 2 solutions, find  $\angle B$  and draw the 2 triangles. (4)
19. A vertical tower sits on a slope that makes an angle of  $9^\circ$  with the horizontal. The tower's shadow is 106 meters long and points directly up the slope. The angle of elevation of the sun is  $21^\circ$ . How tall is the tower? (3)
20. A clock has an hour hand that is 5 cm long and a minute hand that is 8 cm long. What is the distance between the tips of the hands when it is 10 A.M.? (3)

**Partial Answers to 912-015 Final for Winter 2009**

- 1 (a)  $T$  (b)  $F$  (c)  $F$  (d)  $T$  (e)  $T$  (f)  $F$  (g)  $F$  (h)  $T$  (i)  $T$  (j)  $F$
- 2 (a)  $10\sqrt{2x-1}(x-2)$  (b)  $\frac{1}{2}, 2$  (c) 90
- 3 (a)  $(-\infty, -2) \cup (4, \infty)$  (b)  $(1, \frac{7}{3})$
- 4 (a)  $x - 2y + 11 = 0$  (b)  $y = -2x + 13$  (c)  $y = \frac{3}{2}x - \frac{3}{2}$
- 5 (a) see your teacher (b) 3, 0,  $DNE$ , 4,  $\infty$ ,  $-\infty$
- 6 (a) 3 (b)  $\frac{-2}{3}$
- 7 (a)  $10x - 3$  (b) 7
- 8  $\frac{1}{1-x}$
- 9  $(-\infty, -1) \cup (3, \infty)$
- 10 see your teacher
- 11 (a)  $-2, 1, \frac{1}{2}$  (b) 5 (c) 4 (d)  $\frac{2\pi}{3}, \frac{4\pi}{3}$
- 12 (a)  $4\left(x - \frac{1}{2}\right)^2 + 2$
- 13  $LHS = \frac{\frac{\sin^2 x}{\cos^2 x} - 1}{\sin x + \cos x} \cdot \frac{\cos^2 x}{\cos^2 x} = \frac{\sin^2 x - \cos^2 x}{\cos^2 x (\sin x + \cos x)} = \frac{(\sin x - \cos x)(\sin x + \cos x)}{\cos^2 x (\sin x + \cos x)} = \frac{\sin x - \cos x}{\cos^2 x} = RHS$
- 14 8250
- 15 55.29
- 16  $48.58^\circ$
- 17 129.53
- 18 2 triangles  $\Rightarrow \angle C = 58.05^\circ, \angle B = 76.95^\circ$  and  $\angle C = 121.95^\circ, \angle B = 13.05^\circ$
- 19 56.77
- 20 7