Math151 Answers for Sample Problems Fall 2011

1. (a) $< -\frac{3}{5}, \frac{4}{5} >$

   (b) $\cos\theta = -\frac{8}{\sqrt{5}\sqrt{13}}$

   (c) $\text{comp}_{\vec{b}}\vec{a} = -\frac{8}{\sqrt{13}}$, $\text{proj}_{\vec{b}}\vec{a} =< \frac{16}{13}, -\frac{24}{13} >$

2. $W = 80\cos(40^0)$

3. $\frac{13}{5}$

4. Vector equation: $\vec{r}(t) =< 1+t, -3+4t >$ or $\vec{r}(t) =< 2+t, 1+4t >$. Parametric equations: $x(t) = 1+t$, $y(t) = -3+4t$ or $x(t) = 2+t$, $y(t) = 1+4t$

5. Jump discontinuiuty at $x = 2$

6. Vertical asymptotes: $x = 1$, $x = -1$. Horizontal asymptote $y = \frac{1}{3}$

7. (a) $\frac{dy}{dx} = (\sin x)^x(\ln(\sin x) + x\cot x)$

   (b) $\frac{dy}{dx} = \frac{\sqrt[5]{2x-1}(x^2-4)^2}{\sqrt[3]{1+3x}}\left(\frac{2}{5(2x-1)} + \frac{2}{x-2} + \frac{2}{x+2} - \frac{1}{1+3x}\right)$

   (c) $\frac{dy}{dx} = -\frac{\sqrt{1-t^4}}{2t\sqrt{1-t^2}}$

   (d) $\frac{dy}{dx} = \frac{1-4x-2y}{2x+2y}$

8. $y = \frac{7}{4}(x-1) + 2$

9. (a) $v(t) = 3t^2 - 12$, $a(t) = 6t$

   (b) $t > 2$

   (c) 23

10. $\vec{v}(1) =< 1, 15 >$, $s(1) = \sqrt{226}$, $\vec{a}(1) =< 0, -10 >$

11. $y'' = 16\text{e}^{-5x}\cos 3x + 30\text{e}^{-5x}\sin 3x$

12. $\frac{d^{50}}{dx^{50}}\cos 2x = -(2^{50})\cos 2x$

13. -0.15 rad/min

14. $\frac{1}{x} \approx \frac{1}{4} - \frac{1}{16}(x-4) + \frac{1}{64}(x-4)^2$

15. $g'(1) = \frac{1}{2}$

16. 4

17. $\frac{3\pi}{4}$

18. (a) 1
    (b) 0
    (c) 1

19. The absolute maximum value is $\frac{4}{27}$. The absolute minimum value is -4.

20. (a) No vertical asymptotes. Horizontal asymptote $y = 0$ as $x \to -\infty$
    (b) f is increasing on $(-\infty, -2) \cup (0, \infty)$. f is decreasing on $(-2, 0)$
    (c) f has a local max at $x = -2$. No absolute max. f has the local min at $x = 0$.
    (d) f is CU on $(-\infty, -2 - \sqrt{2}) \cup (-2 + \sqrt{2}, \infty)$. f is CD on $(-2 - \sqrt{2}, -2 + \sqrt{2})$
    (e) f has inflection points at $x = -2 - \sqrt{2}, -2 + \sqrt{2}$.

21. $r = h = \sqrt[3]{\frac{V}{\pi}}$

22. $f'(x) = \frac{x}{2\sqrt{x}(x+1)}$

23. (a) $\frac{29}{6}$
    (b) $\frac{2}{5}(2^{5/2} - 1) + 2(2^{1/2} - 1)$
    (c) 3

24. $\frac{16}{3}$

25. $s(t) = \frac{t^4}{12} - \frac{t^3}{6} + 2t + 1$

26. $\vec{r}(t) = < \frac{t^3}{3} + t + 1, \frac{t^2}{2} + t >$