1 Evaluate $\int x \cos^2(3x)\, dx$

2 Evaluate $\int e^{2x} \sin x \, dx$.

3 Could you in principle compute $\int x^{10^{10}} e^x \, dx$, and if so, how?

4 Evaluate $\int \sin^3(x) \cos^4(x)\, dx$.

5 Evaluate $\int \sec^4(x) \tan^4(x)\, dx$.

6 What substitution would you use to evaluate $\int x^3 \sqrt{16 + x^2}\, dx$?

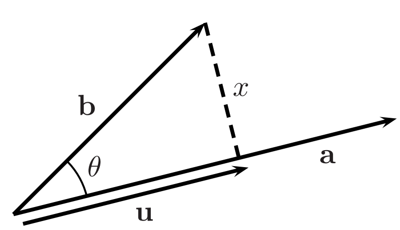
7 Evaluate $\int \frac{dx}{(9 - x^2)^{3/2}}\, dx$.

8 Is the angle between the vectors $\mathbf{a} = \langle 3, -1, 2 \rangle$ and $\mathbf{b} = \langle 2, 2, 4 \rangle$ acute, obtuse, or right?

9 Find the area of the parallelogram whose vertices are $(-1, 2, 0)$, $(0, 4, 2)$, $(2, 1, -2)$, and $(3, 3, 0)$.

10 If $\mathbf{a}$ and $\mathbf{b}$ are both nonzero vectors and $\mathbf{a} \cdot \mathbf{b} = |\mathbf{a} \times \mathbf{b}|$, what can you say about the relationship between $\mathbf{a}$ and $\mathbf{b}$?

11 Consider the vectors $\mathbf{a} = \langle 4, 1 \rangle$ and $\mathbf{b} = \langle 2, 2 \rangle$, shown below. Compute $\cos\theta$, $\mathbf{u}$, and the length x.



Note: you should not leave unevaluated trigonometric functions in your answer.

12 Find the equation of the plane which passes through the point $(2, -3, 1)$ and contains the line

$$x = 3t - 2, \quad y = t + 3, \quad z = 5t - 3 \ .$$

13 Find the line of intersection of the planes $x + y + z = 12$ and $2x + 3y + z = 2$.

14 Compute the position vector for a particle which passes through the origin at time $t = 0$ and has velocity vector

$$\mathbf{r}(t) = 2t\,\mathbf{i} + \sin t\,\mathbf{j} + \cos t\,\mathbf{k}.$$

15 Show that if a particle moves at constant speed, then its velocity and acceleration vectors are orthogonal. Note that this does *not* mean that the velocity is 0! (Hint: consider the derivative of $\mathbf{v} \cdot \mathbf{v}$.)

16 Consider the curve defined by

$$\mathbf{r}(t) = \langle 4 \sin ct, 3ct, 4 \cos ct \rangle \ .$$

What value of c makes the arc length of the space curve traced by $\mathbf{r}(t)$, $0 \leq t \leq 1$, equal to 10?